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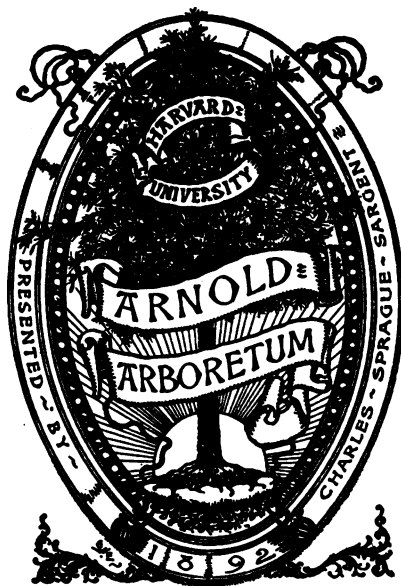
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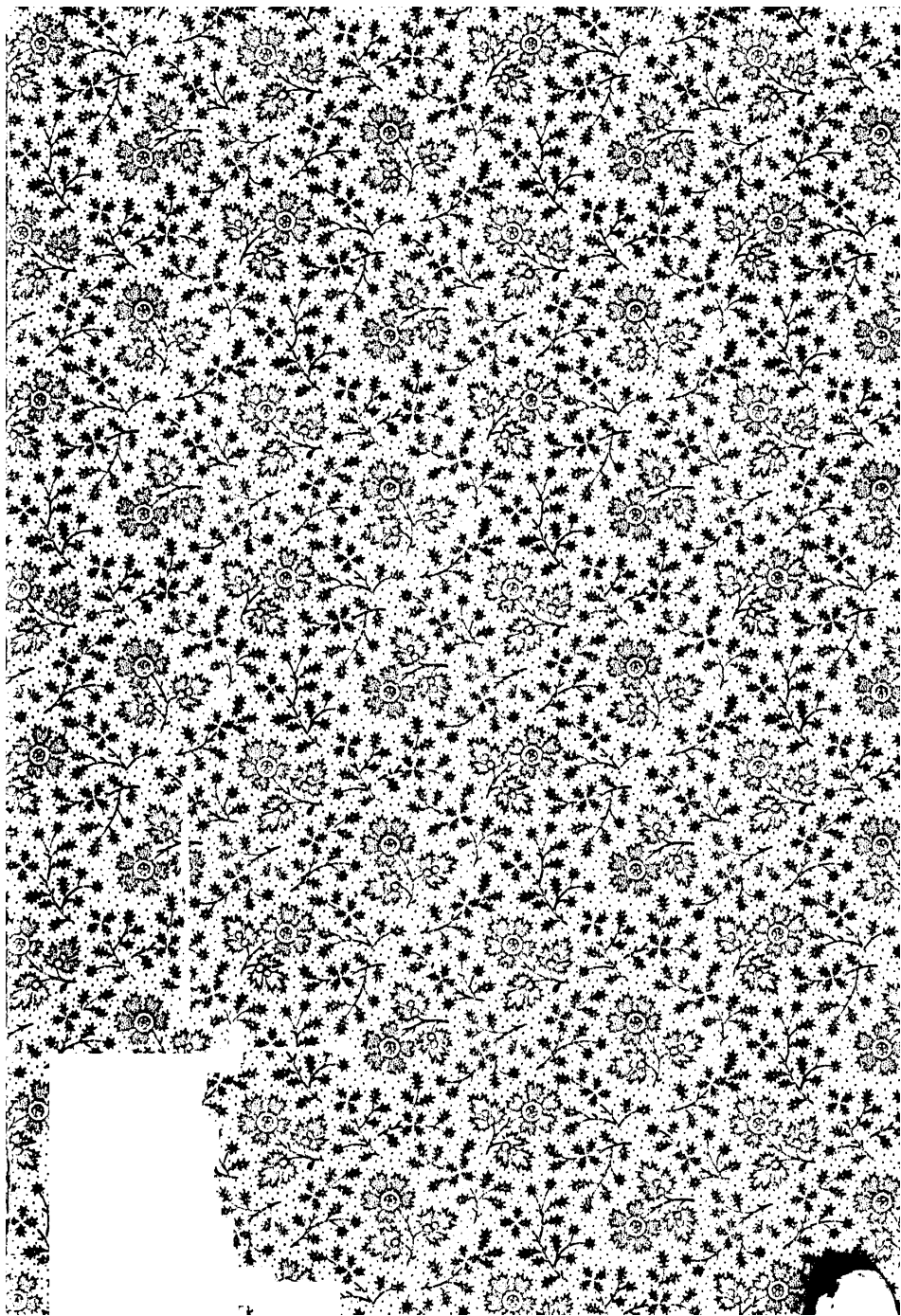
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JOHN COOK OF BALTIMORE

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COMMERCIAL
ROSE CULTURE

UNDER GLASS AND OUTDOORS

A PRACTICAL GUIDE TO MODERN METHODS
OF GROWING THE ROSE FOR
MARKET PURPOSES

ILLUSTRATED

BY EBER HOLMES

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TO
JOHN COOK

BALTIMORE, MD.

This work is respectfully dedicated

To him the rosarians of America are indebted for the dissemination of much knowledge concerning the Rose as adapted to American culture, and its commercial possibilities. To him, also, we are indebted for many varieties resulting from his skill and years of patient labor and experiment in hybridization, among them, Souvenir of Wootten, the first Hybrid Tea Rose raised in America, Marion Dingee, Annie Cook, Mrs. Robert Garrett, Baltimore, Enchanter, Cardinal, Madonna, My Maryland, and Radiance, some of which have become staples in the underglass production of Roses for the requirements of the great flower markets. The liberality with which his knowledge, obtained at the expense of countless experiments and failures, has always been placed at the service of others, has endeared him to all followers of his craft, one which, more than any other, demands the acme of patience and self-sacrifice in order to accomplish lasting results.

“The lyfe so short, the craft so long to lerne.”

ACKNOWLEDGMENTS

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commencing on page 161.

INTRODUCTION

THIS little book has been published in response to numerous requests for an uptodate work on commercial Rose culture. It will not delve into the ancient history of the Rose or indulge in long descriptions and classifications of varieties. These points have been well covered by previous writers. The author will endeavor to point out to the beginner, the small grower, or the florist with a retail trade, who grows a few Roses with his general stock, the best way to be successful in growing good Roses under glass and outdoors. There is hard work in quantity and much expense in modern Rose growing, but the pleasure and profit derived from the same afford ample compensation.

The magnitude of the business, as compared with its status of twenty-five years ago, is surprising. Parsons, in his book on the Rose, published in 1881, on page 71, speaking of the extravagance of Nero in spending \$100,000 for Roses for one feast, says: "It would be no easy matter, even at the present period of abundant cultivation of Roses, to obtain from all the nurseries of England, France and America together, Roses sufficient to amount to so large a sum." Compare these words with present day facts, when there are probably as many Roses handled in any one of our largest cities, at every holiday, as were ever seen by Nero at any of his feasts!

The question was asked me, a few months ago, "Why is Rose growing in the hands of a few ~~men~~, while Carnations are tried and grown (often successfully) by every beginner in the florist's business?" The reply generally given to this question is that Roses require more care, are more liable to diseases and pests likely to cause failure, that a night man must be kept by the Rose grower, and that the general expense is such as to bar out the man of limited means. While this may be partly

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true, it is often exaggerated, as there are today many small Rose growers who are eminently successful, and who make more money, in comparison with capital invested, than some of the larger ones do.

The multitude of diseases and pests may be narrowed down to about half a dozen serious ones, and these, in turn, if understood and taken in time, may be so controlled that little harm will result from them. Neglect of proper care is responsible for the majority of failures.

Where Roses are understood and properly treated their culture is as simple as that of other florists' flowers. It is an advantage to any man to take a course in one of our agricultural colleges, or to work a few years in one of our modern and fully equipped commercial establishments. Good reading is also to be recommended, but the beginner will find he will learn more after a few years' personal experience, with the responsibility on his own shoulders, than he would in a much longer period where he is watching someone else do the work. There is something new and interesting to learn about Rose growing every day. The care required is constant, and the old saw, "Eternal vigilance is the price of success," is perhaps more true of Rose culture than of any other branch of the grower's art.

EBER HOLMES.

MONTROSE, MASS., October, 1911.



LYON ROSE

A splendid garden and exhibition variety

Courtesy Henry A. Dreer, Inc., Philadelphia, Pa.

CHAPTER I

CHOOSING A LOCATION

THE first essential when locating a Rose growing establishment is good soil and plenty of it. Land that will grow good corn, or any ordinary garden crop, may be made to grow good Roses. Buy as much land as you can afford at the start, for this generally proves a good investment in any case. Small lots of land will do for the town florist who grows for a retail trade and buys a large part of his goods, but for the wholesale grower twenty-five acres is about as small an amount of land as it is wise to commence with. There are successful men with less, but most of them would like to obtain more land, as they feel the pressing need of obtaining an unlimited amount of good, fresh soil for their houses. The most ill advised action any man can take is to buy land with a lot of drawbacks in the belief that he can overcome all the objections, later, by hard work. A little foresight in locating is better than a great deal of hindsight later on.

An average level field, large enough to build houses east and west, at least 300 feet long, is desirable. If grading on an extensive scale has to be done it will add considerably to the first cost of building, at a time, too, when it is necessary to avoid every possible extra expense. It will be found that the cost of grading will, in ordinary cases, be about one dollar for every one hundred cubic feet of material used if the haul is less than half a mile and the filling easily obtained. In some cases all that is necessary is to remove the sod and loam and erect the houses without any filling. The ground should be high enough and have natural drainage so that it will not lie



ROSE DOUBLE WHITE KILLARNEY

The coming white Rose. Plant all that you can of this

Courtesy A. N. Pierson, Inc., Cromwell, Conn.

under water at any time of the year. A southeast to southwest exposure is the best.

If a natural shelter exists on the north and northwest, it is well; if none is there, it is advisable to plant trees which, in a few years' time, will make a windbreak. The water supply is important and should be one of the first considerations. If a stream runs through the property, from which water may be pumped, it will save the expense of driving a well and will possibly give water on which Roses will thrive better than on well water. I do not mean to condemn well water, for it is generally used with good results, but I believe that water from streams is often better for plant life if only from the fact that the wash it contains from the land through which it flows is of some value as a fertilizer. It is generally very soft and the next best article to rain water which old gardeners used to catch and carefully preserve for use when watering their plants. Where there is city or town water to be had at reasonable rates this source of supply is generally adopted. The cost will vary, but might approximate \$100.00 per year for every 30,000 square feet of glass. Some people claim to pump their own water from streams or wells for one-tenth of this sum but, when everything is figured in from first cost of installing a pumping outfit to labor and fuel in running it, it looks as though a man could soon use up two dollars a week on a place of any size.

In choosing a location avoid branch railroads and, if at all possible, get near to a station on the main line. The wisdom of this step, when receiving coal and all other freight, as well as when making the daily shipments of flowers or plants, will soon be apparent. Good shipping facilities are indispensable to any establishment, and proximity to express offices is advantageous.

Cow manure is an item to be considered and, if there are

dairy farms in the vicinity where this can be obtained, it will be in favor of the location.

Due consideration should be given to all these and other questions which will need to be solved when looking over farms with a view to starting a Rose growing establishment. Having secured the land, the next thing to decide on is the style and size of the house or houses.



SUNBURST

Courtesy E. G. Hill Co., Richmond, Ind.

CHAPTER II

STYLE OF HOUSES

IN building a house for Rose growing, the most sheltered and sunny part of the field should be chosen where there is room to run east and west. A good size for a beginner would be a house 300 feet long and between 30 and 40 feet wide, although the length and width may be greatly increased if desired. Houses up to 32 feet in width may be built even span; for houses much wider, three quarter span is better. Iron, or semi-iron construction, is much in favor at the present time, although good wooden houses are built for a little less money and, if taken care of, will last a lifetime.

There are a number of reliable firms of builders of green-houses of every description, and it would be well to get estimates and specifications from several of these and to compare same carefully before giving out any contracts. If the order is given in due season, these firms will erect a house in short order and have it ready when they agree to, which is worth a great deal when it is considered that every day's delay in planting, after the first of July, means an actual money loss. After the middle of July this loss has been placed at twenty-five dollars per day for every day's delay in planting 10,000 square feet of bench surface.

The material may be bought and erected by local labor, from plans furnished, or the builders will erect the house. The latter way would probably be the cheapest in the end for a man with little experience in this work. One point worth remembering is, that the average carpenter who has never erected an iron frame greenhouse has a very poor idea of how to commence and carry on the work.



ROSE LADY HILLINGDON

**The Queen among Yellows. Promises to be a very profitable variety.
A splendid grower and a ready seller**

Courtesy Chas. H. Totty, Madison, N. J.

The walls of the house may be of wood, or of concrete up to the glazing sill, which should be so placed as to allow from two to four feet of glass on the sides of the house. A great many builders use a spliced sash bar on long roofs; there is often more or less drip in a house where this is used, which is objectionable. It is possible to obtain sash bars in one piece, up to thirty-five feet in length, from some firms.

Sixteen by twenty-four-inch glass is the size commonly used and this is generally laid with the long part of the glass up and down the roof. By laying the glass the twenty-four-inch way you save one sash bar in four, but the bars must be made heavier and there is more danger of breakage from snow and ice, so that it is advisable to space the bars about sixteen inches apart to admit of the glass being laid in this way.

It is best to have continuous ventilation on both sides of the roof. The ones on the north side will not be of use in the Winter months, but all through the warm weather it is advisable to ventilate on both sides and to allow the air to circulate through the top of the house instead of beating down on to the bushes, as it must do where there is only an opening on one side and the wind is blowing in on that side.

The house ought to have a good coat of paint before erection and another one afterward.

If a natural slope exists on the ground where the boilers may be placed below the level of the houses, without digging a cellar, it is of great help and will save money as well as give good results. There is nothing to beat a good gravity system where this is possible. If this is not feasible, on account of the cost of excavating, the boilers may be set on top of the ground and the condensation returned by a trap or a pump.

Provision should be made for a manure tank, a room for grading and storing the cut flowers, a potting shed and a place for propagating young stock. There should be room, under cover, to store enough loam in the Fall to take care of the

potting until March or April. Where any quantity of soil is required early in the Spring, for planting, it may be stacked up in a semi-dry condition in the Fall, in a compact pile; it will not freeze through to any great depth and may be handled at almost any time.



ROSE FRAU KARL DRUSCHKI

CHAPTER III

WHAT TO PLANT

TO the beginner the question of what to plant may be a perplexing one. As this is such a large country, it is only natural that some varieties are more popular in certain sections than others, or that some varieties are more successfully grown in one locality than in another. A good rule would be to find out what your market calls for and what kinds are successfully grown in your vicinity, and to commence with these kinds. It is too risky for a beginner to launch out on unknown seas. He must follow the beaten track at first, and then, by degrees, he can experiment with new varieties, and should he strike a good thing he will make money.

The Killarneys, pink and white, are grown and are popular nearly all over the country. Richmond, for a red Rose, is almost as popular. Then we have almost a score of others which are largely grown, but not so universally found on the market as the three kinds first mentioned.

It is not advisable for an inexperienced man to try to grow American Beauty Roses. This crop does not always pay well, even with expert growers, and the tyro would be very likely to lose money if he attempted it.

There has been much money wasted in experimenting on a large number of greenhouses and, if you can profit by your neighbor's mistakes, you will get your experience very cheaply. Having decided what you will grow you can figure that you will require about 8000 plants for every 10,000 square feet of bench surface. You will do well to order these ahead from some reliable firm or firms and to specify just when you want



ROSE MRS. A. R. WADDELL
A novelty in demand in the best stores

them delivered. Then your part will be to hustle everything along and get your houses roofed in on time; your loam on the benches, the water pipes laid, faucets all in position, and everything in readiness for planting. It would be better, too, if the boilers were set, piping done and everything in readiness to turn on steam at a few hours' notice, but this is not so important as it is to avoid delay in planting.

If the roof is tight, and the sides and ends closed in, you can plant at almost any time after the middle of May, but do not plant until the roof is covered. You can hurry along the steam fitting while the plants are growing; you may not need it for some little time, but it is better to be prepared.

When ordering plants you may be in doubt as to whether to order grafted or own root stock. In this you can be guided to some extent by what others are doing in your locality. Some varieties, like *Madame Abel*, *Chatenay*, *Perle des Jardins*, and others, do better on their own roots than they do grafted, in fact, the last named will not succeed grafted on *Manetti*, but does very well indeed on the *Banksia* stock. That fine new yellow, *Lady Hillingdon*, seems to be equally at home on *Brier*, *Banksia* or *Manetti* stock. *Prince de Bulgarie* does well either grafted or on its own roots. Other kinds, like *My Maryland*, are grown successfully by some growers when grafted, while others, equally as skillful, will have none of this variety, except on their own roots. Other kinds, like the *Killarneys* and *Richmond*, will do very well indeed either way.

The own root stock may be bought for about half the price of the grafted, but you will probably cut two crops of flowers in the Fall off the grafted plants before you get any from the own root stock, so that the higher priced are likely to prove the cheapest in the end.

If you find it impossible to be ready for planting at the specified time you can generally make arrangements to have your plants held a little while. As soon as you receive them.

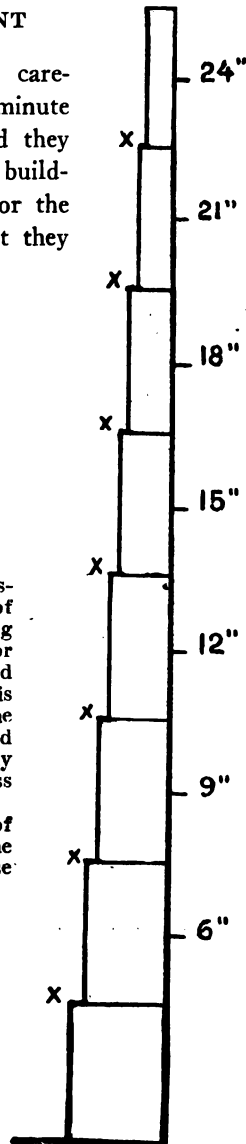
WHAT TO PLANT

they should be unpacked and planted carefully. Your care of them begins the minute they are landed on your property, and they must not be neglected in the rush of building and other work on a new place, or the returns next Winter will not be what they ought to be.

GRADING STICK

This illustration represents the measure designed by Wm. H. Elliott of Brighton, Mass., for use in grading Roses, and is very useful, especially for beginners; it also insures a standard length in all grades. The measure is of wood tapering to 1 in. wide at the top; the bottom has a brass plate screwed on $3\frac{1}{2}$ in. wide by $1\frac{1}{4}$ in. deep. Any Rose which measures below the cross (X) marks goes into the lower grade.

The A. T. Stearns Lumber Co. of Neponset, Boston, Mass., will supply one of these measuring devices to any Rose grower on request.



CHAPTER IV

PROPAGATION—OWN ROOT

AS we get down to Rose growing proper it may be best to begin with the plants in their primary stages. If you want to produce own root stock, the methods employed are easy and simple. You should have a propagating house; this need not be large and may be situated on the north side of your larger house. It should have continuous ventilation along the top and is much improved if you can admit light and sun through the north wall of your Rose house by means of windows. If these windows slide, you will be able to admit air on days when it is not advisable to open the ventilators on your north side lean-to. These same openings will, at certain seasons, be of use in admitting warmth to the propagating house.

The bench to hold the cuttings should be built so as to allow drainage of the sand, no matter whether that structure be of wood, tile or cement. Four or five inches of edge board will hold enough depth of sand. Two or three steam pipes, boxed in underneath, will provide enough bottom heat. These should have valves so that they may be shut off altogether, or in part, as required. The best and cleanest sand you can get is none too good for propagation purposes; the kind masons use for setting bricks is just right. A good whitewashing of hot lime, in which a little sulphur has been boiled, is of great benefit as a preservative and sweetener of the bench.

Fill the benches with sand, pound down well with a brick or a wooden mallet, water thoroughly and insert a thermometer in the sand. The cuttings may be inserted as soon as the sand is warmed up to 60° F. or over. The best temperature for a

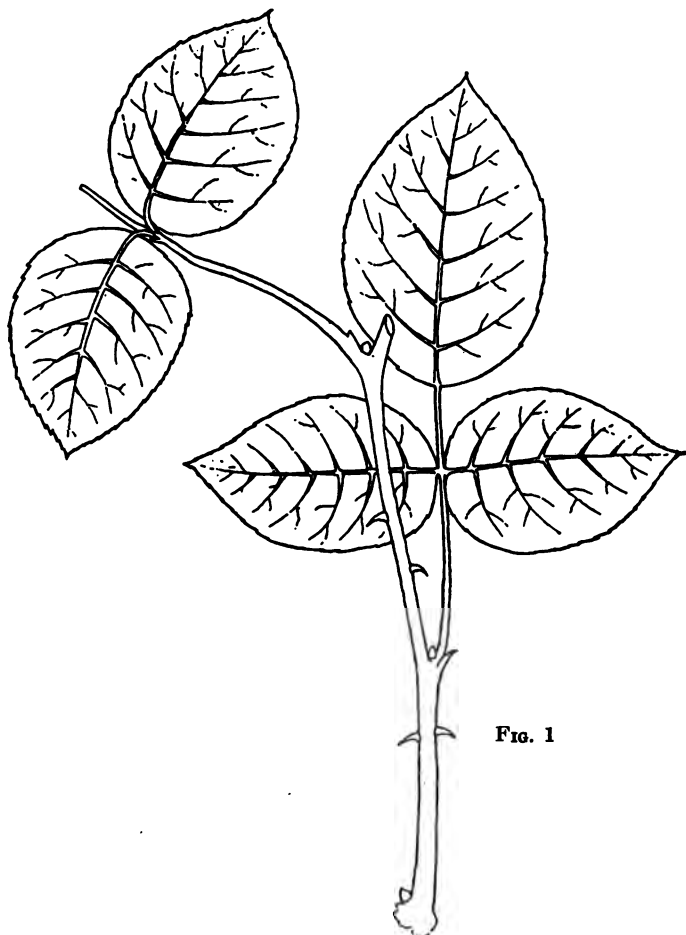


FIG. 1

A three-eye cutting

propagating house is one about the same as the plants were growing in. The bottom heat may be five degrees warmer.

Do not take cuttings from any but healthy, vigorous plants. Early in the morning, or on a cloudy day, when the wood is fresh and comparatively cool, is the best time to take off wood for cuttings. Blind wood, or wood without a flower bud, is generally used for this purpose. It should be plump and clean, not so soft that the point can be pinched out with the thumb, and not so old as to be very hard and dry. Wood of about the same texture as that next to the flower when it is cut, is in the right stage of development. If you can afford to throw away some flowers, or if you can use them short stemmed, you can utilize your wood for propagating. This, however, is a slow process and only done on a small scale, often with new or scarce varieties. This wood does not root readily if too hard, or if the stem is large and pithy.

I believe in cuttings with two or more eyes (see Fig. 1). They may be rooted with only one eye (see Fig. 2), if the object is quantity rather than quality, but cuttings with two or more eyes will make much larger plants in a short time than those with only one.

Cut off as much wood as you can handle in a few hours' time, sprinkle with water to keep it fresh, and then proceed, with a sharp knife, to trim the cuttings as shown in Fig. 3. As soon as they are ready, use a narrow board or a lath, for a straight edge, and draw an old table knife or a putty knife alongside it, making a cut in the sand about half an inch deep, insert the cuttings just deep enough so that they will not fall over and place them as close together as possible without crowding them; then, by moving the lath to the other side of the row, and pounding gently on it a little, the sand will be tamped down enough to make the cuttings solid, and the knife drawn alongside again to mark the place for the next row.

This is a quick way of putting in cuttings when the work is properly done; they must be set in so firmly that the waterings will not knock them over. Use a sprinkler on the end of the hose and, with a gentle spray, give a good watering, enough to settle the sand firmly around each cutting. If the drain-

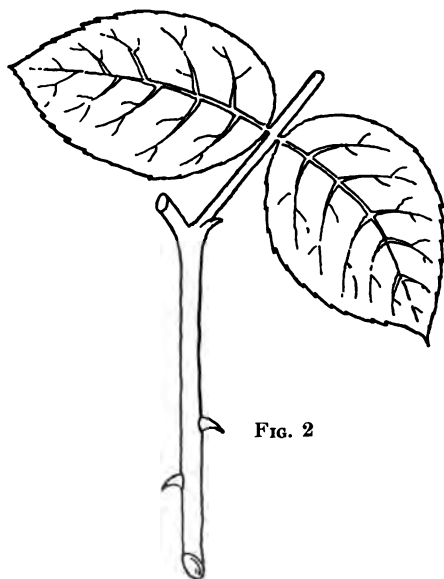


FIG. 2

A one-eye cutting—not recommended

age is all right, water every day for ten days, and afterwards as needed. Do not let the sun or wind in on the cuttings to wilt them, but be sure to keep them fresh, as cuttings once wilted are never so good. The same is true of young plants in any stage; any check they get is liable to react against them later.

In about three weeks' time the cuttings may be examined by inserting a knife and prying them up gently out of the sand. As soon as they have made roots about half an inch long they should be potted. If this operation is long delayed, the plants will suffer as there is no nutriment in the sand to sustain any growth that they may make. The roots also lose their plumpness, become long and brittle, are easily broken off when dug up from the sand and while being potted, and are much injured thereby.

The soil for the first potting should contain no fresh manure, nor any chemical fertilizer. Good Rose soil, mixed up the previous Summer with a little cow manure, will be in the right condition by this time, by which I mean anywhere between December first and April first. If this is stored outdoors, or in a cold shed, it should be brought inside long enough beforehand to get well warmed through before it is required for use. Screen and rub all lumps of sod and manure through a three-eighths inch screen; a one-fourth inch or one-half inch one will do if you have not the first named size. This is done to make the plant food it contains available, to avoid breaking the roots by trying to crowd them into a small pot with lumps of earth, and also to greatly increase the speed in potting, for it is well known by growers of small stock that a man can pot into small pots much faster when using screened loam than he can with rough material.

A 2-inch or $2\frac{1}{4}$ -inch standard pot is large enough for the first potting. Pot firmly, but not too deeply—and to about the same depth as the cuttings were in the sand. Do not set the roots to the bottom of the pots, nor so near the top that they will not stand firmly upright, and pot them all alike. If you knock the plants out of the pots, after a good man has been at work, you will find every plant just about the same as regards depth, firmness of potting, etc. Water carefully by sprinkling them gently several times and then examine several pots to see

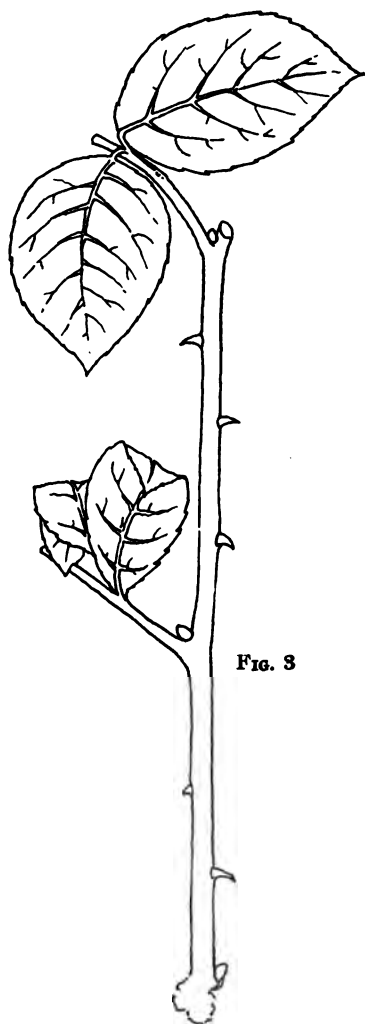


FIG. 3

A three-eye cutting trimmed ready for the sand bed

if they are uniformly moist. Do not water them enough to make them muddy.

It will save a lot of work and care if you can place your young stock near the propagating house; if your potting bench can be located in the propagating house it will save a lot of carting around. In any event, place the stock on the best and sunniest bench you have got, setting them level on fresh screened coal ashes. Shade the stock for a few hours daily, for the first few days, if sunny, reducing and discontinuing this as soon as possible. Water carefully every day or two, as needed, syringe well every fine day, once or twice, according to conditions, to keep down insects and to induce the lower eyes to break. Never allow the plants to become dry and do not get them too wet as then there is danger of souring the soil. A happy medium, such as will soon make itself apparent to you, will be the right condition to keep your young stock in. Have the foliage dried off before nightfall.

Give the best of care and repot into larger pots as soon as the small pots are full of roots. Pot into the same kind of soil that you used at first, with the addition of a sprinkling of bonemeal. A pot one inch larger will be large enough, and then, if necessary, you can give them still another shift later. Although this is seldom done, it is much better than making too large a shift at once or than allowing the plants to remain in one pot to spoil.

CHAPTER V

PROPAGATION BY GRAFTING

THE first step toward grafting will be to order the Manetti (which is the best stock for this purpose) in good season. It is advisable to order in the Spring for Fall delivery. This stock may be imported from the British Isles or from the Continent. French grown Manetti may be bought for less money than the British, but the percentage of loss is greater, as a rule, and the stock is not so carefully graded, so that the difference in first cost is offset by results later. No one need be afraid of French grown stock. It is simply a case of where the lowest priced article is not always the cheapest.

The Manetti generally reaches this country about the first of December. As soon as received it should be unpacked. If frozen when received it should be allowed to thaw out gradually, in a cold place, and then should be potted into good soil in small pots; 2¼-inch or 2½-inch pots are large enough for this purpose. If larger ones are used they take up too much room in the case, and the soil is more likely to sour. Soil such as was recommended for potting cuttings out of the sand is good for potting Manetti. Some growers add a sprinkling of bonemeal to this, when potting, which promotes a more vigorous growth of the grafted plant. An experienced commercial grower tells us that he always top dresses his young grafted plants with bonemeal which promotes a quick, vigorous growth.

If the roots of the Manetti are too large to insert in the pots, they may be trimmed with a sharp knife. Shorten back, or cut off altogether, some of the large roots, making a clean cut, leaving on as many of the small fibrous roots as possible.

Pot firmly, leaving the top of the soil nearly one-half an inch below the top of the pot. This allows low grafting, which means that the plants may be planted into a shallow bench and yet have the graft covered with soil, which is considered by some good growers as essential to success. However, I have seen grafted stock doing well when planted with the graft exposed above ground. When potted, place the plants on a bench of clean ashes in a cold house, water well once and then, after the first day, spray very lightly, several times daily, to keep the tops moist, but do not keep the roots too wet. Keep the house as near 46° as possible.

The stock will be ready for grafting in from three to five weeks after potting, according to conditions. As soon as the buds swell and the roots show, they are ready to graft. While the stock is rooting is the time to get the grafting case ready, if this has not been done previously. This may be built on one end of the bench where you root your cuttings, but will require more pipes underneath, as the bottom heat must be greater. A temperature of 80° to 85° is required for this.

For a bench three or four feet wide, from four to six 1¼-inch steam pipes will be enough to maintain this heat if the sides and ends are boxed in tightly. Every pipe should have a valve on both ends so that the heat may be under control at all times. Use matched boards for building the frame, and make the glass cover thoroughly tight, for on this much of the future success depends. Build the case large enough to accommodate as many plants as you wish to graft and divide it into sections, each independent of the other, and each one tight. Make each section no larger than you can fill in one day's grafting. If you have 10,000 to graft, a case holding about 3,500 will be large enough, for if you commence early you can make three rounds. Each round will take about four weeks in all, although it has been done in less time.

If you adopt this method, instead of trying to graft all your stock at once, it would be wise to pot two-thirds of your stock at first, and the remainder about a month later. Stock for later grafting may be left in the cases in a cold shed away from frost. The case may be the same width as any ordinary bench, but not so wide as to be awkward to work in. It may be twelve inches high outside and eighteen inches high at the

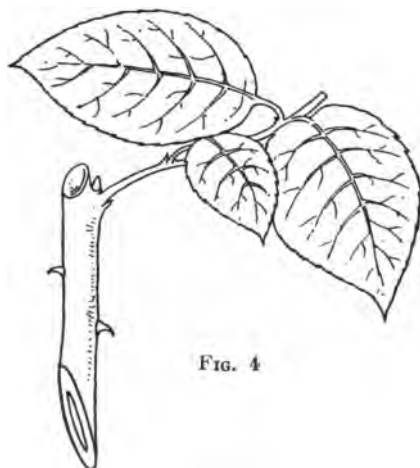


FIG. 4

A cion just cut off the plant

ridge. The shape of it does not matter so long as the essentials are adhered to. The sash and top boards should be painted and the lower parts should receive a good coating of lime wash. About four inches of sifted ashes should be spread on the bottom. These should be packed down and well watered,

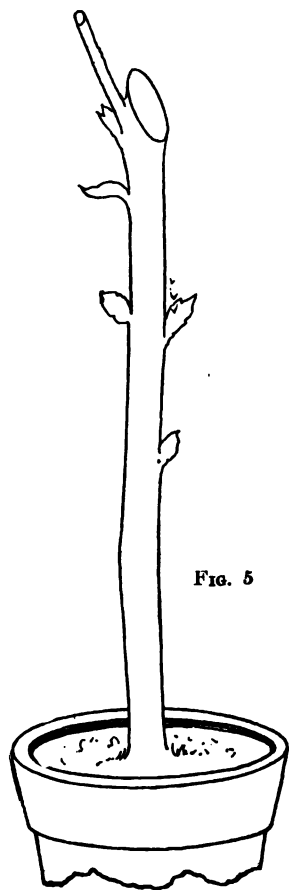


FIG. 5

Manetti stock ready for the case

and the case closed tight the day before being used, which induces the warm, moist condition necessary for best results.

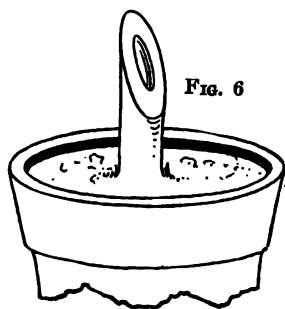
The stock to be worked will be in better shape for handling if it is well watered the day before being used. It will then require no more water at the root for nearly a week, which makes the danger of getting water in the cut much less.

When the days get short in the Fall we light up at about 4.30 p.m., and the boys amuse themselves by cutting raffia into lengths of about twelve inches and splitting it up into the required thickness. If this is too thin, it does not work so well, and if too thick it makes a bungling job. When cutting the flowers it is best to leave one or two good eyes with plump buds on the plants, just before grafting time. You can go around with a basket and collect these, when wanted. If you cannot get enough in this way it is best to sacrifice a few flowers; a rose worth eight cents, at wholesale, will cut up into four to six cions worth one and one-half cents each. This wood should never be allowed to wilt. Sprinkle it the same as cuttings, but do not soak it in water for any long time.

It is a good practice to plant enough plants of the varieties needed for propagation by themselves and keep the flowers pinched off these. Much time will then be saved in taking cuttings when needed.

The stock should be picked out and placed in flats and be in a convenient position, always selecting the ones with good roots and plump eyes first. We use two knives, a common shoe knife, or a cheap knife bought from the nurseryman's supply house, for the stock, and a grafting or budding knife, such as florists use, for cutting the cions. Use nothing but the best, healthy wood, with plump eyes, for this work. Some growers use a rack for holding the pot, which leaves both hands free; others take up the pot in one hand and work with the other. There is no difference in the time it takes; it depends altogether on the operator. Make a slanting cut, as low down as possible on the

stock, commencing as close to the soil as you can and working upward. Cut the cion to match and fit them together. If stock and cion are both of the same size, and well matched on both sides, it is a perfect piece of work. The inner bark of both must come together on one side at least, and it is better to make a perfect union on one side regardless of the other than to try to match both sides, and fail because stock and cion are



Manetti stock cut down ready to receive cion

of unequal size or the work improperly done. When matched, tie them together by wrapping raffia around, and tying with a loop knot, or passing the end underneath the last lap and draw tight. This operation ought to be done quickly but carefully. The beginner will have to go slowly at first, but with practice he will soon become expert.

In our illustrations Fig. 4 shows a cion just cut off the plant. Fig. 5 shows the Manetti stock ready for grafting; Fig. 6 is the Manetti stock cut down ready to receive cion; Fig. 7 shows the finished grafted plant ready for the case.

As soon as a flat is full, the plants should be set into the case and closed tight, being kept shaded all the time if the sun is shining on the house. The stock, when cut with the knife, should look fresh and sappy. If it looks dry and hard it should be rejected. Close up air-tight as soon as the case is full, always keeping the cions from getting dry in the meantime. Keep a thermometer in every compartment and let it stand as near 80° as possible, a few degrees higher is better than a degree or two lower. If the cover of the case does not fit tightly, lay strips of paper in and shut down on to this. If the tops look at all dry, they may be sprayed with a florist's atomizer before being closed.

The case need not be opened again for five days. Then open it early in the morning before there is ventilation on from outside and before the sun is up to wilt the cuttings. Open wide for five to ten minutes and then close again. After two or three days of this treatment, a very little air may be left on altogether, increasing this each day until, in about three weeks from the time you commenced to open first, you can leave the cover off altogether. The bottom heat may be reduced at this time also. Very little water will be required the first week in the cases, but afterward, as air is admitted and the plants grow, they will require considerable, as the bottom heat will evaporate a lot of moisture.

During the first few days, when they are to be closed in tightly, you can tell by looking through the glass whether they are all right or not as regards moisture. It is possible that foliage will look dry. If this should happen take off the cover, spray with a fine sprayer, with warm water, and close again immediately. If there is too much moisture in the case mold

will appear, in which event a very little air might be carefully admitted to help dispel this. But this tinkering ought not to be necessary if everything has been properly done.

If your cases are built in sections, as soon as one end is empty and cleaned out, it is ready for the next round. Watch the plants carefully the first few days after taking them out of the cases. Shade them a little, if needed, but never when you can get along without it. Give the plants the warmest and most sunny bench you have, and they will grow rapidly. After a few weeks they will need to be staked and tied to prevent being broken when syringed with the hose. If the Raffia is tight at this time, it may be cut away before it damages the bark. Take good care of these plants and you will have good stock at planting time.

PROPAGATION BY SEEDLING AND BY BUDDING

Propagation of Roses by seedlings is a slow and expensive process, and is not to be recommended to the beginner. Several thousand seedlings might be raised without getting one worth growing. The men in this country and abroad who are engaged in this work have, in many cases, spent years of time and labor, to say nothing of money, and are deserving of great praise for the results so far attained. But this is not a work for the Rose grower who must make a living, and who is struggling to get established in business.

Propagation by budding is simple. It is practiced but little inside, but outdoors it may be sometimes necessary or advisable to use this method of propagation. Manetti makes a good stock to bud on. This stock may be planted out early in the Spring, in rows eight inches apart and three feet between the rows. Bud in July or August as low as possible.

There are two things necessary in budding: First, a well established, healthy stock plant; second, a well matured bud. The wood is in the right condition when the bark will peel

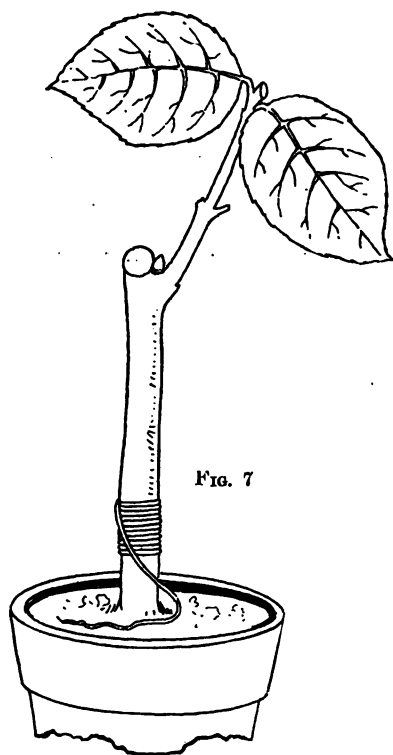


Fig. 7

The finished grafted plant ready for the case

easily from it. This may be tested by running the knife under the bark. Use a thin and sharp budding knife, make a longitudinal incision about three-quarters of an inch long, another short one across the top, making it T shaped; run the knife under the bark to loosen it from the wood, and cut off the bud you wish to insert, taking with it a thin scale of the wood if the shoot is young. If the wood is old the bark will be sufficient. Cut the bark about one one-quarter of an inch above and below the bud. Raise the bark on the stock with the budding knife, insert the bud carefully as far as it can go, and bind with raffia. This may be cut away in about two weeks. Rather cool, cloudy weather is best for this operation. In hot, dry weather, the buds are liable to perish before the union is effected. Break off any shoots which attempt to push out below the bud and, as soon as the bud commences to grow, cut off the old stem above the bud as close as convenient, making a clean slanting cut on the opposite side of the shoot.

CHAPTER VI

HYBRIDIZING

A CHAPTER on this subject having been asked for, the following has been written.

Hybridizing is the art of bringing together individual flowers or plants of different species. Cross breeding effects similar results with individuals of the same species.

The average Rose grower has little time or inclination to practice this art and, when we consider that a man might raise thousands of seedlings, which take up valuable time and space for months and sometimes years, only to find them all worthless at the end of it all, we understand why so few attempt it and feel genuine admiration for our pioneers in America who have done such noble work in this direction.

Generally speaking, a man to be successful in this work must follow out a well defined and systematic course when crossing Roses; he must know just what he is striving for and select his parents with that end in view and, most probably, will have to keep this up for years, perhaps discarding 20,000 seedlings before he gets one worth growing. And yet there is another side to this.

It is a fact that occasionally, a beginner will make a cross which turns out well and this element of chance is so alluring that it is well worth the attempt. It has been asserted by eminent Rosarians that there is no limit to the diversity or variation of Roses produced from seed. Some have sown thousands of seeds of certain varieties without obtaining one of the same kind. It is commonly thought that the double varieties do not perfect their seed as well as the more single ones, but

this has been proved incorrect, and it seems to be of more importance as to what the shape of the flower is like rather than as to how many petals it has.

Certain varieties seem to be incapable of forming perfect seed, especially such as have the petals rolled inwards. Other kinds, having perfect pistils, will, if the flowers are allowed to remain, form seed pods which dry up before arriving at maturity. Such as these will often perfect their seed if artificial impregnation is practiced.

If a large number of chance seedlings is the object, select a piece of good ground, well prepared, and plant on it a collection of the best varieties obtainable. Do not prune these too closely but, when the flowers are about to develop, all the poor ones may be removed, leaving the good, well developed ones to flower and seed at will.

A better way would be to carefully select flowers for crossing and hand fertilize them, keeping a record of operations. In this case care has to be used that promiscuous crossing, or self-fertilization, does not take place. To guard against the former cover with netting to keep away insects about the time the pollen is ripe and, as a preventive of the latter, pry open gently the flowers to be operated on and remove the stamens with a pair of round pointed scissors. This may be done just before the flower is ready to open, say the night before; if delayed until the pollen on the stamens is ripe, which is about the time the flower is expanded, it may be too late to prevent self-fertilization.

Fragrance is an object which should be sought after in a new Rose; other qualifications are habit, form, color, freedom of bloom, hardiness, if for outside planting, and continuity of growth and bloom in Winter, if for indoor culture.

It has been asserted that, to obtain double flowers, preference should be given to double and semi-double varieties for seed bearers; varieties should be selected with broad, thick, well



ROSE MRS. AARON WARD

Possesses handsome foliage, produces enormous crops. Likes a little extra warmth in Winter

Courtesy E. G. Hill Co., Richmond, Ind.



ROSE RADIANCE

A tried and true Rose. Has been very profitable the past few years

Courtesy A. N. Pierson, Inc., Cromwell, Conn.

formed petals, with perfect pistils and stamens visible. An absolutely double flower would not possess these qualifications and so would be incapable of producing seed.

Single flowers will bear seed that will never produce more than a semi-double variety. Since American growers have been raising seedling Roses, rapid strides have been made in the advancement of a type or, rather, two distinct types of plants suited to our requirements—one for outdoors and another for Winter forcing.

It is best to plant the Roses intended for seed bearers away from others and to select varieties differing in color and habit. The pistils or female organs of one are to be fertilized by the stamens or male organs of the other. A stamen with no anther or pollen bearer is barren. A pistil is composed of the ovary or embryo of the seed. Down in the center of the flower, and rising from it, is a filament called the style (or center) and the stigma or point to which the pollen is applied. This terminates in a rather thickened point, and is pierced with an imperceptible opening through which the pollen is carried to the ovule, which latter develops into a seed.

Authorities differ as to which of the parents the seedlings will most resemble and this question need not much concern the amateur. It would require years of study to reduce this question to a science, and personal experience will probably be the best teacher.

When the flower is fully open it must be fertilized with another of a variety from which it is desired that the qualities be largely perpetuated in the seedlings. The two flowers selected should be in about the same stage of development. The anthers may be pressed between the thumb and finger and, if the yellow dust sticks to them, it is ripe and ready to use. It would be best to carry a flower of the male parent to the seed bearer. It may then be held over the latter flower and, by placing a finger over the bottom flower and striking the pollen bearer

gently on it, the pollen will be shaken off and the work done. Or the pollen may be collected on a camel's hair or very fine brush, and thus conveyed from the anthers of one flower to the style of the other.

The flower should then be protected so that neither the wind nor insects are able to carry other pollen or interfere in any way with the work done. When the flower has passed away, if the cross has been successful the seed pod will soon swell. If any decayed petals adhere to it they should be removed and the pods should be left on the bushes until fully ripe. Protect from birds or anything that might damage them, if outdoors.

The same operations, just described, may be carried on in an airy greenhouse, the plants to be grown in pots, as well as outdoors, with the advantage of a longer ripening season.

John Cook tells us that 50 per cent. of the seeds will not germinate, 25 per cent. will come single and out of the remaining 25 per cent. may be obtained two or three varieties worth growing on.

Care must be taken, when syringing, about the time of fertilization, that no water gets into the flowers.

The seed may be sown as soon as ripe. It should be rubbed out between the hands before being sown. Hard pods may be crushed and rubbed through a wire screen after which lay in the air to dry. If the seed is old, soak in water over night before sowing. Sow the seed in flats or pans filled with a mixture of loam and leaf mold; well mix in equal parts and see that the boxes or pans are well drained. After the seed is sown, water carefully, and cover with about one-half an inch of the same mixture to which a little sand has been added. They may then be placed in a cool greenhouse and should be kept moist.

It will take months for all the seed to germinate. They will require the same care and protection from harm that any other seedlings do. Flowers will probably appear on the seedlings within a year. Some of the Bourbon and Chinese varieties

have been known to flower when five or six weeks old. It is best to prevent rather than to encourage flowering at such an early stage, so that a good plant may be built up. As soon as they flower all inferior blooms may be destroyed; preserve the best ones and, to save valuable time, eyes may be budded or cions grafted on to a vigorous growing stock. (See chapter on The Seedling-Inarch and Nurse-Plant Methods of Plant Propagation.)

The Manetti is commonly used in America for this purpose. The Brier is preferred for certain kinds and other wild or hardy stocks may be tried. The Banksia stock has been proven very good for yellow varieties.

It will take several years to test a variety and to try it out properly and decide whether it is worth growing and putting on the market. There are many qualifications a Rose must have and nothing hurts a firm's reputation more than to send out a variety that will not prove desirable or profitable to grow.

It is suggested that experiments be made in crossing the hardy varieties or, at least, infusing some hardy blood into the crosses so as to raise kinds which will be able to withstand the severity of our American climate. The Rugosa, Wichuriana and others of this type, are good to use for this purpose. It would seem that to make the Rose more popular with the masses varieties that succeed outdoors would be in great demand.

CHAPTER VII

THE SEEDLING-INARCH AND NURSE-PLANT METHODS OF PLANT PROPAGATION

For the matter which follows, we are indebted to the Department of Agriculture, Washington, D. C., our material being extracted from Bulletin No. 202, Bureau of Plant Industry, by Geo. W. Oliver. In an introductory note therein, David Fairchild, the agricultural explorer, in charge of the department of Foreign Seed and Plant Introduction, says:

"One of the most important factors in the creation of a plant industry which depends upon a perennial species is the rapid propagation of the plant. The possibility of bringing through the mails from any part of the world a few seeds of some rare plant is of relatively little moment if it is not backed up by adequate methods of quick reproduction from these few seeds, through asexual propagation, in order to produce large numbers of individuals for experimental trial. One of the greatest drawbacks of horticulture is the time required to test a new variety originated from seed, and any method which shortens the time required to make such tests must appeal to everyone, whether an originator of new varieties or a tester of them, as of the greatest value.

"The seedling-inarch method which has been worked out by Mr. Oliver, it is believed, is destined to prove of the greatest importance not only in connection with the propagation of the tropical and subtropical fruits and ornamental plants with which this Bulletin particularly deals (because it has been in his studies with them that he has come to realize its value), but in a very wide range of plant industries in which the early fruiting

of a variety is very desirable. This shortening by a year or more of the time required for the fruiting of a new variety is believed to be a matter of such unusual importance as to be worthy of the widest publicity among all interested in the cultivation of plants. The discussion embodied in this Bulletin, while it indicates the present stage of our studies of certain tropical fruit industries, must be considered as having a much more general application than to these few new fruit possibilities which are as yet little known to the American public."



FIG. 1. Rose seedlings, a cross between two varieties, four weeks after germination. Each seedling is grown close to the rim of a 2-inch pot so as to facilitate an easy approach to the stock plants when inarching

Those parts of the Bulletin which will especially interest our readers are here given:

While investigating the asexual propagation of some tropical fruit trees and other plants, at the request of Dr. B. T. Gal-
loway, chief of the Bureau of Plant Industry, it was discovered by the writer that a large number of hard-wooded shrubs and trees are capable of very rapid increase when propagated by processes which may be termed the seedling-inarch and nurse-plant methods.



FIG. 2. The Rose seedlings shown in Fig. 1, four weeks after germination, prepared for inarching

These methods are inexpensive and, owing to their simplicity, may be used by persons without previous experience in the propagation of plants. By these methods the ever-increasing number of plant breeders will be able to save much time in determining the value of hard-wooded plants raised by means of hybridization. They can be used in manipulating seedlings of rare trees and shrubs intended for crossing so that each plant will bloom in a much shorter time than if left to grow on its own roots. Seedlings of all hard-wooded plants resulting from collections made by travelers in foreign countries may thus be brought to the flowering stage and their value determined quickly.

The most remarkable feature of the new methods lies not only in their simplicity but also in the certainty of the unions which result. The writer has had very few unsuccessful unions and none among those classes of plants where the most suitable stocks are known and in common use. Not only is it possible to inarch a seedling a few weeks old to a large stock, but a moderate sized seedling stock can be inarched to a shoot of a rare shrub or tree having the same diameter as the stem of the seedling. A satisfactory union may thus be induced where other methods of asexual propagation have invariably failed.

Rose seedlings resulting from crossing varieties have been inarched on Manetti stocks when the seedlings were from three to four weeks old, and they produced maximum sized flowers long in advance of those on seedling plants growing on their own roots. The rare Finger Lime, *Citrus australasica*, sometimes seen in a dwarf, sickly condition in greenhouse collections, has borne fruit two years after inarching on one of its congeners; and within nine months after flowering, hybrid seedlings between this Citrus and a cultivated Orange were in their turn inarched on two-year-old Lemon seedlings.

Very young seedlings of hundreds of other rare hard-wooded plants may be worked on the same or allied species or genera,

and their value determined much in advance of the time when they would flower on their own roots, or on plants obtained by grafting or budding from the mature shoots of the seedlings.

Hard-wooded seedlings which need to be flowered in the shortest possible space of time, in order to determine their value, are used for inarching as soon as the first leaves attain a fairly



FIG. 3. Rose seedlings, four weeks after germination, inarched to stocks of the Manetti Rose. During the process of uniting the seedlings are kept in a moist and growing condition by the soil held around the union by burlap. A good union is effected in three to four weeks

firm texture, as, for example in the case of the Mangosteen. But when seedlings are used as stocks for the vegetative propagation of established varieties by uniting the stocks to small branches, then larger seedlings are used, as for example, in the case of the Mango.

INARCHING ROSE SEEDLINGS

Seedlings of some of the Rose groups resulting from crossing distinct varieties or otherwise take more than one season to produce flowers of maximum size to enable the breeder to judge of their merits. They take much longer to develop when budded on Manetti or other stocks, because in that case a considerable time has to elapse before the growth of the seedling is strong enough to give buds and wood fit for propagation by budding or by grafting. Rose seedlings three to four weeks old, or after the first few character leaves are developed, lend themselves very readily to the seedling-inarch method of propagation. Tea and Hybrid Tea seedling Roses will give flowers of maximum size very quickly after the tiny seedlings are inarched to strong-growing Manetti or other stocks, thereby saving much time in preliminary tests.

The operation of inarching is simplified if each seedling is pricked off into a 2-in. pot shortly after the cotyledons are developed. The seedling should be placed as near the rim as possible (Fig. 1). In two or three weeks the seedling makes sufficient growth to be removed from the pot, when a little fresh soil is held in place around the root by a piece of cloth about 5 in. square (Fig. 2). The ball containing the roots of the seedling is secured to the stock, the stem of the seedling being placed close to it, so that the inarch may be easily accomplished (Fig. 3). The union is a rapid one and becomes perfect some time before the cotyledons decay.

It is well known that many seedling Roses on their own roots produce flowers before the cotyledons decay, but the flowers are necessarily small and have little to indicate their eventual value. The seedling-inarch system shortens very considerably the period between germination and the production of flowers of maximum size—a material aid to the breeder in determining the value of the seedling within a few months after germination (Fig. 4).



FIG. 4. Inarched Rose seedling, showing the growth made in two months after inarching. (One and one-fourth times natural size)

Seedlings raised from seeds of new and rare trees, shrubs, and vines may be induced to grow very quickly if used as cions when a few weeks old, by inarching to strong-growing plants of other species of the same genus, or in some cases on species of other genera of the same family. This has been done recently with such plants as Chestnuts, Walnuts, Hawthorns, Oaks, and many others. It is not necessarily done for the purpose of hastening the flowering or the fruiting of new plants, but to give quickly an abundance of material for propagation by budding or grafting when the new material is assumed to be valuable.

If a hard-wood seedling of hybrid origin is tied to a large stock and they fail to unite, there is little or no danger of losing the seedling, provided its roots are kept damp during the period of making the attempt. If the inarch is not successful, the seedling can be repotted and grown in the usual way.

CHAPTER VIII

PREPARATION OF THE SOIL FOR PLANTING

THE best soil for planting Roses is that taken from the top of good pasture land out of the open field. Avoid hedgerows, and loam from under trees, as this is liable to be either full of insect pests or sour. Plow up as much as you need in the Fall or in early Spring. Sod is easier to work after Fall plowing. If you wait until Spring, plow early and take off the loam before the grubs come up from their Winter quarters. For small growers, the old-fashioned loam pile may be the best method.

Commence by laying out the shape and size desired by placing the sod and loam about a foot thick. On this spread four inches of good fresh cow manure and keep this up until you have a pile about six feet high which, when covered with loam, will consist of one-fourth or one-fifth good cow manure. Turn the top layer of sod grass down. Do not take off more than six inches of loam from the field. In two weeks this loam pile may be chopped down, well mixed and turned over, choosing good sunny weather for this work. After two weeks more it may be turned over again and is ready for use. This is the old-fashioned method.

On most large places today, a pair of horses and a disc-harrow are put on to a piece of ground to cut up the sod after plowing. The top loam and sod are then scraped into rows about a foot deep and as wide as can be worked with the harrow. The manure is spread on and mixed with the harrow. On some places, lime or bonemeal is mixed in at this time. This way is much quicker than piling up loam and chopping



ROSE SUNBURST

One of the novelties soon to be introduced. Will undoubtedly be valuable and popular
Courtesy E. G. Hill Co., Richmond, Ind.



ROSE KILLARNEY

Has produced more sports than any other variety. A charming Rose

down by hand, and has the advantage of exposing the soil to the sun and air all the time.

Roses may be successfully grown on benches or in solid beds. On some of our largest places benches are used altogether; on others we find all solid beds. Whatever style is used good drainage is essential. On most places there is little difference in the results at the end of the year, providing all the essential details have been carried out. If the benches give a little better result in Midwinter, the solid beds will probably make up the difference in the Summer. Benches should be built rather narrow than wide, as the former are easier to work among and give better results. The best Roses are grown on the outside of the benches, where they get the maximum amount of air and light; those in the middle of a very wide bench are always the poorest. Five feet is the widest a bench should be built. We prefer one four feet wide, and plant four rows of plants, sixteen inches apart in the row. Other growers get good results on benches four feet three inches wide and plant five rows sixteen inches apart.

The sides of the benches may be six inches deep, which allows for topdressing, and plants may be grown successfully several years in such a bench. When the benches are filled with loam, the top of the soil should be level with the bottom of the glass in the sides of the house.

Solid beds are best made by building a wall of cement, brick, or tile, of the required height, and filling in the bottom with any good drainage. These walls need not be more than 2 inches thick if good material is used. These need not be built as high as the benches, on account of the expense, but should be well up into the light. Give the benches a good coating of lime wash and fill the house with the loam as quickly as possible. Never handle the loam when it is wet if it can be avoided. Put on as large a gang as possible, for this is the hardest work of the year, and the mutual benefit the men get from having a crowd

able to handle the work well and quickly, when all are doing their best, will mean better work in a shorter time. And time is money in planting Roses for, as soon as they are planted, they begin their work and never cease until they are thrown out or dried off the following Summer.

The easiest way to fill houses is to have a movable sash on the sides of the house, then to draw the carts alongside and to throw the loam inside to the men, who pass it along and spread it on the benches. This is a much quicker way than the old-fashioned wheelbarrow method, although, in extra wide houses, it might be wheeled inside to advantage. On up-to-date places a movable track and trucks on four wheels are used. These trucks will hold from four to six times as much as a wheelbarrow and may be easily operated by two men. Six men will do as much with these as twelve men can do without them on long hauls. Level off with a rake, as you go along, so as to make sure of getting the benches filled evenly. Tread down after filling, unless the loam is wet or of a clayey nature. It may then be raked lightly to give it the final leveling, then marked off.

We use a marker, made of light wooden strips, after the style of a tooth harrow. It is just wide enough to fit inside the benches so the plants can never get out of line. Commence by setting it down on one end of the bed, pressing it into the soil so as to leave the marks where the plants are to be set. Twenty-four holes can be marked off at one time, when lifted by one man (or by a man on either side, for more rapid work); it is set down again with one row of pegs in the end holes; in this way every place must be accurately marked and the time saved is considerable. A line is often in the way when planting, and time is lost in moving it from one place to another. With the marker the full width of the bed can be planted at once if necessary.

Let a good man pick out the stock; all poor plants should be rejected. It costs no more to care for good ones and the returns are much larger than from the inferior plants. It will keep two men busy carrying in the plants and setting them out on the benches, two more to dig holes, and two of the best men to plant.

As soon as planted the soil around each plant should be pounded down with a piece of hard wood, making it firm and leaving a slight hole around each plant so that it may be watered without wetting all the soil in the bed. Give the plants a good soaking to settle the soil well around them; no more water is then to be given until the plants are on the dry side, but syringe well several times daily and damp down the walks and beds to maintain a growing atmosphere.

There is little fear of too much damping down in the scorching days of Midsummer; with the houses wide open evaporation is rapid, and the plants will not make a good growth unless well damped down; but avoid soaking the loam in the benches or it may sour. Cultivate the ground by scratching over the top once a week for a few weeks. This will kill the weeds, aerate the soil and conserve the moisture.

As soon as the roots spread through the benches, discontinue the cultivating, or be very careful to go lightly on top so as not to injure the roots. Keep the young plants tied up and keep them clean in every way. Increase the water given as the plants grow, but always be careful in the Fall not to overdo it. As the nights lengthen and get cooler, reduce the syringing and damping down processes and always have the foliage dry before sundown.

Before leaving the subject of planting I might mention that a cloudy day is much the best for this work—best for the men, and also for the plants. On at least one of the largest commercial ranges I know of a gang is put on at 4 a.m. and the planting for the day is finished by 9 a.m.

The old loam from the houses may be spread back on the land, reseeded, and in a few years' time will be good to use over again, if needed. There is nothing better for topdressing grass land than old soil taken out of the Rose benches.

Plant the varieties subject to mildew away from others not so liable to be affected, and plant some Richmond, Killarney, and similar varieties, in solid beds, if possible, as these come with more substance in the hot weather on solid beds than on benches.



ROSE DARK PINK KILLARNEY

Courtesy A. N. Pierson, Inc., Cromwell, Conn.

CHAPTER IX

GENERAL CULTURE

THE work after planting will consist of careful attention to detail as regards the culture of the plants and in pushing ahead all unfinished construction work as quickly as possible. The time passes very quickly and the sooner everything is in good shape the better it will be. The heating apparatus should be tested and kept in readiness for use as soon as needed.

The object, at first, is to get the beds filled with roots and to get good healthy plants of a fair size. The flower buds are cut off through the Summer and thrown away. Some growers take off the buds when about the size of peas, while others leave them until the flower is open before removing them. I would advise taking them off as soon as they show color. We are guided by the size and condition of the plant when disbudding. Take off any useless wood with the bud, but leave on every good leaf and eye; generally one or two of the top leaves only are taken off when throwing away the buds.

After the plants have attained some size, say in September, a few of the best buds on each plant may be allowed to develop, still pinching off the buds from the smaller wood. This helps to build up the plant and, when the flowers are removed, there is not such a shock given the plant as when all the flowers are removed at once. The smaller plants may be disbudded up to the time that they catch up to the larger ones when they will be in good shape to work all through the Winter months.

If flowers are desired for special occasions, eight weeks should be allowed, in Midwinter, after the final pinching, and

six weeks in Midsummer. This time is approximate; it could not be given exactly, as time varies with the ever changing weather conditions, and what is just right this year may be a week or more wrong the next.

Where a succession of bloom is desired, which is really what every man needs, a good plan is to start the plants flowering at intervals of two weeks, dividing them up into as many lots as possible or desirable, according to the size of the place and the requirements of the market.

Staking should be done as soon as possible after planting. We use stakes of No. 9 wire, four feet long. These are fastened with clips at the top, to a wire running the length of the bed and securely fastened and held tight on the ends; No. 18, or bench wire, is used for this. This wire, and the stakes, are galvanized and last a great many years. These are for Tea and Hybrid Tea Roses. For American Beauty Roses an arrangement of wire and strings, such as is used for Asparagus, Smilax, or Chrysanthemums, is generally used.

Tie up all plants neatly and carefully in such a manner that the string will not cut the bark, and avoid bunching the foliage. Never crowd the leaves. Simply tie up the shoots for support, always leaving room for the sun and air to get at the plants and on the beds, and for the water to reach every part when syringing.

Watering must be done carefully, especially in the dark days of Winter. Generally speaking, this can be done about once a week on light soils, all Winter, but no rule will apply everywhere alike. It is better to err on the under watering side than to overdo it in November and December, although I have seen benches, which would not dry out, which were benefited by having a thorough soaking of warm water applied so heavily that it ran through the bottom and cleared away any sourness which might have been existing in the soil. After the middle of January, or early February, Roses will take more

water, and it is almost impossible, as the season advances, to overdo this if only reasonable care is used.

We commence using manure water on the young stock in the early Fall, giving it lightly and using it weak at first, increasing the strength and quantity used as the conditions warrant. Little but the regular weekly application of manure water is used through the Winter, although this has to be governed by conditions. When planting we use nothing but cow manure in the loam. About September or October, we apply a light dusting of bonemeal, using about 100 lbs. for every 2000 square feet of bench surface. This may be worked into the soil by rubbing over lightly with the fingers, and then covering with an inch or more of equal parts of good cow manure and loam, and well watering. Be careful after this that the beds do not get too wet with the subsequent waterings. This mulching will carry the plants through the dark days. If too much is applied, making a heavy blanket on the beds, harm is often done as the beds cannot dry out and the loam gets cold and sour.

Toward Spring, when the sun gets powerful, it is often beneficial to apply a good coating of green cow manure, covering this with a sprinkling of loam to keep the nitrogen from escaping. A little air should be left on the house day and night for two or three nights when applying this, or the foliage may be burned. It is best to apply this manure when the beds are in a condition to take water; then give a good soaking as soon as the manure is on, and cover with loam before night. In this way nothing is lost and the loam covering is not washed down immediately. If the beds do not require water at this time, cover with loam as soon as the manure is applied and let stand for several days before watering; by so doing the beds will absorb some of the nitrogen from the manure, but not so much as when watered in at once. This is considered the best way by some growers.



ROSE KILLARNEY QUEEN

Large growth like American Beauty. Not so free flowering as the common Killarney from which it sported

Courtesy A. N. Pierson, Inc., Cromwell, Conn.



ROSE RICHMOND

This photograph taken Sept. 1, shows Richmond a good Summer Rose when well grown. The best Winter red Rose.

Ventilating is an operation so simple, and yet so important, that special mention should be made of it. In the first place, sudden changes should be avoided. In Midsummer the houses are wide open at the top and often the end doors are open, in addition to side ventilation in very wide houses. And yet there is not a night in the hottest weather when this air is not reduced, commencing to reduce earlier in the afternoon and to increase later in the morning as the cool weather approaches. There is no set time for this. A cold storm may come in Midsummer, making it imperative to reduce air and start the fires, but, as a rule, the transition is gradual and almost imperceptible, like the changing seasons.

Some air is left on all night, excepting in the cold Winter months. When three or four $1\frac{1}{4}$ -inch steam pipes will not keep up the required temperature in a house 32 feet wide, the night man closes the house for a few hours; and it is the same with houses 50 to 60 feet wide, if five pipes, or six at the most, will not keep up the warmth. In warm weather, in Spring and Fall, the steam is turned on as soon as the temperature commences to fall, which is between 8 p.m. and midnight, according to the season, and left on a few hours, when it is taken off and turned on again in the early morning, about daylight, for two hours more should it have been too warm to keep up the heat all night.

We always keep one or two pipes painted with sulphur and use these at this time of the year. In the Winter, little air can be given, but in the Spring, as the sun gets stronger, it is most important to commence to ventilate early. A good grower will anticipate the changing temperature, the object of which is to increase the amount of air without lowering the temperature in the houses. Increase the air little and often, and let the rise be gradual from sunrise to noon; the fall from noon to sunset to be along the same line.

Always avoid draughts when ventilating. Where the house

has continuous ventilation on both sides of the roof this is easy, as, by opening both sides a little in windy weather, the air passes through the top without beating down on the plants; or the lee side may be opened wide while the side to windward is kept closed.

All routine work should be done well and on time, and the houses kept clean and plants free at all times from all pests and diseases. Air slaked lime may be sprinkled occasionally under the benches. The walks should be kept clean and free from muddy places or standing water, although they should be damped down often enough so that they are never dust dry.

Such varieties as Kaiserin, Carnot, and others, used for Summer flowering, may remain for years undisturbed and produce the best flowers in this way. Summer Roses will do well in a house not quite so good as the ones required for Winter, but for Winter work the best houses are required, and, generally speaking, these houses are replanted about every three years.

If one-third of the place is planted every twelve months, you have plants in all stages of growth, and can keep up a succession of flowers all the year around. Commence to dry off a part at a time and rest it about a month. Then you can start a few benches every two weeks, which will enable you to start up the last lot in time to bring in a good crop for Christmas.

It is advisable to leave Roses undisturbed if they are doing well and are desirable varieties rather than to replant. They may be left much longer in solid beds than on benches.

Commence to rest your plants by withholding water gradually and syringing but little. Do not let the soil get so dry that it cracks apart, or the wood so dry that it will shrivel. More harm is done by too much drying than otherwise, and it takes such plants a long time to get a new start. When ready to start a batch, cut them down about halfway; this is an operation which may be varied somewhat. We have had good re-

sults from leaving plants thirty inches high and just as good when they were cut down to within ten inches of the ground. Some growers object to cutting down Killarney. We have had good results in almost every style and would cut back hard any time before the middle of August. After Sept. 1st we would not cut back very much. Some growers tie down their old plants, others prefer to leave them standing upright. There is little difference in the result, perhaps a greater tendency to black spot where tied down as the air cannot circulate through the bushes so well in this case. As a rule the earlier it is in the season the harder we cut them.

As soon as pruned we scrape off the top loose soil, sprinkle with bonemeal, and then apply a good coat of loam and cow manure in equal parts, about two inches thick. The beds are then well watered; this is best done by going over them two or three times, as soon as the covering is on and then repeating the operation the next day. After they are once soaked, no more water at the roots is required for some time, but the tops will require syringing several times daily to induce the plants to make a new growth. As they grow they will require the usual treatment. It is well, when replanting in the Summer, to pot up a few of the best plants before throwing out stock from benches. These will be found useful to fill in any vacant space or to replace poorer plants among the stock carried over.

The best night temperature for the general run of Roses is 58° to 60°. Some varieties require more heat, but, as a rule, these are not profitable kinds for the small grower to handle. The heat should rise to 70° or 75° at noon on every sunny day in the Winter. On stormy, zero days, it will sometimes be impossible, nor is it desirable to increase the temperature more than a few degrees by noon, and in semi-dark weather 68° at noon gives the best results in the long run.

CHAPTER X

INSECT PESTS

GREEN FLY is a pest so common that it needs no description. These insects were hard to overcome and did much damage, years ago, when burning Tobacco stems was in vogue, to the detriment of the flowers. We have now good proprietary articles advertised in the trade papers which are so effective in killing green fly, and so harmless to the flowers, that there is no excuse for anyone being troubled by these pests; the cost of the remedies, although rather high, is not excessive when the results obtained are considered.

In burning the various forms of nicotine paper, follow the directions given as closely as possible. Do not wait until a house is overrun before applying the remedy, but fumigate lightly and often. If you apply preventive measures and never see any green fly, which is possible, you are better off than if you await their arrival and then give a heavy dose. All fumigation is best done on a still night when the air is moist inside. A good, sharp syringing, if the weather is fine the next morning, will clean off and freshen up the plants. In case of neglect, where the fly is thick and established, two or three fumigations, at intervals of one or two days each, will be necessary to clean them out.

Red spider is another pest common in some Rose houses, but is easily controlled if the proper measures are taken for its suppression. It is not usually troublesome on Roses out of doors, but under glass they may breed at any season of the year. These insects are so small as to be scarcely discernible with the naked eye, and their presence is made known by the



ROSE DARK PINK KILLARNEY

A beautiful color and very floriferous. Grow rather cool (56 to 58 degrees right temperature) to get substance in the flowers

Courtesy A. N. Pierson, Inc., Cromwell, Conn.



ROSE MRS. TAFT
(Antoine Rivoire) The most profitable Summer Rose today
Courtesy A. N. Pierson, Inc., Cromwell, Conn.

coloring of the leaf. These insects live on the underside of the leaf; here they lay their eggs, which they protect with a fine silken web, in consequence of which they are hard to destroy.

The best remedy is a good, sharp syringing on the underside of the leaves, taking care to reach every part to dislodge them all. The water must be forcibly applied; it is ineffective otherwise; a pressure of 60 lbs. to the square inch is good; less than 40 lbs. is not enough. A thin, sharp spray is needed, unlike the soft stream used when watering. Sulphur painted on the pipes in sufficient quantity will kill red spider, but this must be kept up for a week or so, as it does not affect the eggs which hatch out and produce a new crop. The objection to sulphur so strong on the steam pipes is that the color of the flowers is damaged thereby and a few leaves may fall from the bushes, but, beyond this, I have never seen any other harm from its use in this way.

A very hot, dry atmosphere in a Rose house is conducive to the spread of red spider and the opposite condition has a deterrent effect. There are good articles on the market for use as a spray against this pest which are worth trying; do not condemn them without a careful investigation.

Thrips are small winged insects less than an eighth of an inch long. The havoc wrought among the foliage by them is similar to that caused by red spider; their presence is noted by the pale mottling of the leaf on which they feed. They also feed upon the buds and are partial to American Beauty. All affected buds should be cut off and burned, and all dead leaves and rubbish kept cleaned away. Fumigate regularly with Nicofume, or similar article, and spray with a good tobacco extract.

Another remedy is to heat iron plates almost red hot; the house must be closed tightly, as it must always be for any fumigating to be effective. Set the plates about 25 feet apart and provide two rows if the house is wide. Commence at the



ROSE DOUBLE PINK KILLARNEY

A sport of great promise. A good Summer variety

Courtesy A. N. Pierson, Inc., Cromwell, Conn.

farther end and place a spoonful of cayenne pepper on each plate, working out of the house as quickly as possible. Do not inhale the fumes as they may be dangerous if the pepper is used freely. This is recommended for American Beauty especially, which is so long in perfecting its flowers that much damage is sometimes caused by thrips. If in doubt as to whether you have spider or thrips, it is important to know that the latter causes white spots on the leaves, while the former shows the foliage brown and often curled under at the edge of the leaves. At first sight, the general appearance is the same and the results are similar, in that Roses can be put out of commission in one or two weeks when *either pest gains a foothold*.

Beetles are sometimes troublesome. There is a weevil of a dull brown color, with a hard shell and a pointed nose with two horns or feelers on the end of it. These weevils eat the foliage. They are about one-third of an inch long; they feed at night and rest in hiding during the day; they may be caught in the early morning easily, as they have no wings. I have seen them in two places recently but, as a rule, they are not a serious menace. If caught and killed when present in small quantities, they are easily controlled. An easy way to catch them is to hang pieces of burlap over the bushes, resting them on the stakes and letting them lie among and on the plants. The weevils will hide in these, and as many as a hundred have been caught in one small house at one time during the past Summer in Massachusetts. A very light jar will dislodge them, and, as they are about the color of the earth, and lie still, shamming death, they are sometimes hard to find if they fall to the ground.

The weevils lay their eggs in the ground. These change to white grubs with brown heads and without legs. The grubs do their damage to the roots of the plants. Carbon bisulphide is used to kill them. Make holes in the ground, where the grubs abound, with a pointed stick. These holes may be one

foot apart or more, according to circumstances. Drop in a teaspoonful of the liquid and cover up the hole at once. This remedy may also be used to kill all other forms of grub.

The white grub so common in pasture lands is sometimes troublesome among Roses newly planted. If a plant suddenly wilts, dig carefully around it and you may find the grub at work, or curled up if at rest, or he may have traveled along to the next plant. Kill him and you may save the plant.

Numerous beetles or chafers attack Roses outdoors. They are of various lengths and colors. Hand picking on cool, cloudy days, or in the early morning, or evening is best. If the grubs in the ground are so numerous as to be a menace to the roots, the ground may be forked up lightly and chickens turned in among the bushes; they will eat the grubs with avidity. Or, pieces of sod may be placed grass side down under the earth where grubs are numerous; these sods will attract the grubs and they may be collected and killed. The carbon bisulphide remedy may also be used. This will kill any and all grubs in the soil without hurting the plants.

Perhaps the most destructive pest on Roses grown under glass, and the hardest to fight, is the leaf roller. These are the young of moths or butterflies, which lay their eggs on the leaves. They hatch into caterpillars about three-fourths of an inch long, which envelope themselves in the leaves, curling them up and, where plentiful, which they are liable to become if neglected, will ruin a house. They fall to the ground when full grown, and enter the soil, where they form a cocoon and remain until early Spring, at which time they come forth and go through the round of reproduction over again, so that once a place is badly infested it is hard to get rid of them.

The best remedies are, hand picking of the caterpillars, spraying the foliage with poison, and catching the butterflies. For spraying the foliage, paris green, not more than a teaspoonful to ten gallons of water, applied lightly every day for a week, has

been known to entirely rid a house of these pests. Arsenate of lead in about the same proportion (which must be kept well stirred while being used) is sometimes used on large places, or on any place where there is a steam pump and manure tank these can be utilized to advantage for poison spraying, and a large house may be covered very cheaply in this manner. For catching the moths, a number of pie plates, filled with water, may be distributed through a house. In the middle of these set a lighted kerosene lamp. The flame will attract the moths; they will then fall into the water and may be collected and destroyed. The work will have to be kept up faithfully, as new crops will hatch out and all cannot be killed at one operation. Hydrocyanic acid gas has been tried without success, so far, for this pest.





ROSE FRAU KARL DRUSCHKI

An American lady in Europe last Summer thought this a wonderful new Rose. Her gardener showed her the same thing at home

CHAPTER XI

FUNGOUS DISEASES

AS stated previously, the pests and diseases of the Rose are not so formidable or so dangerous if the proper remedies or preventives are applied in time. It is when neglect has allowed the disease or insect to gain the upper hand that serious results follow. Healthy plants are seldom a prey to disease or insects, but the surest way to invite failure is through a weak, unhealthy plant. The old saying, "Prevention is better than cure," is as true here as in any other case. Disease and death do not come to the Rose plant in a day unless some gross breach of fundamental law has been committed. A fungus spore may fall on a leaf today, germinate and pass into the interior of the leaf, where it commences to form a spawn that thrives on the materials which the plant needs for its own use.

This process of growth varies somewhat with different kinds of fungi, but generally takes from one to two weeks after infection before the leaf shows any signs of the parasite. When the spawn reaches a certain stage, it shows itself by different colored patches on the surface of the leaf, generally brown or yellow. Later, the fruit of the fungus bursts through to the surface, and it is at this time that it is very infectious. Every person who has seen mildew in this stage knows that it is almost impossible to check its ravages. A few spots showing in a house today will, if unchecked, in a few days or a week, result in an epidemic which will soon ruin the whole crop. It should be remembered that mildew is ever present, and only waiting for a favorable opportunity to develop, and spread itself. The reason it is so troublesome at times is because of neglect in fighting it



ROSE MRS. JARDINE

A great favorite with the ladies. Fine for select trade

when it was present in its weakest form and could then have been easily overcome. Foliage which is soft, caused by improper cultivation, is an easy prey to this disease, while healthy, leathery foliage is comparatively immune.

The best remedies and preventives against mildew inside are good, strong, healthy plants, united to cleanliness and careful watching as to detail in cultivation. Avoid overwatering in dark weather, syringe carefully and not too often in the Winter time. Keep a little sulphur painted on the pipes all the time when firing, and dust a little dry sulphur on the foliage in Midsummer when there is no fire. Let this remain on the bushes, with one or two days of hot sun on it, before washing it off. Renew the application as soon as the bushes are dry, if necessary. When the first spots of mildew show in a house, the affected leaves should be picked off and burned. If this is persisted in for a few days the disease may be kept from spreading, if the sulphur remedy is kept up.

A muggy atmosphere in a house, induced by too much damping down and too little air, will cause mildew to spread rapidly. When mildew reaches the fruiting stage, the white powder is carried by the wind and spread, or it may be carried on the clothing from one house to another. At this time it may be drowned out by continuous syringings which wash off and beat down the spores, destroying a great many of them before they can get a chance to alight on a favorable place to reproduce themselves. If mildew has been present in the Fall, all the leaves that were affected, which show signs of its presence, should be removed and destroyed, or an outbreak is certain in the Spring. When syringing to destroy mildew, always work to drive it away from (instead of on to) benches that are clean.

Black spot is a disease confined to the foliage, and mostly troublesome in the Fall and Winter under glass, particularly on American Beauty and Richmond Roses. It appears in the

form of black or purplish spots, sometimes almost circular and about one-fourth of an inch in diameter, or the spots will be irregular in outline. The blotches are most distinct on the upper side of the leaf. Although looking black to the naked eye, if examined with a microscope, a delicate white cobweb will be seen covering the patches and stretching toward the outside. This, in time, develops into minute black specks, which is the fruiting stage. It is easily spread around and soon defoliates a house.

The precautions necessary call for similar treatment to that prescribed for keeping away mildew as regards air, cleanliness, and water. Overwatering, sudden checks, drip in a house, and all similar conditions, will induce its appearance. As a further preventive, spraying with potassium sulphide, if commenced early and continued every ten days, is good, or any of the regular copper solutions may be used. When the disease appears, all affected leaves should be picked off and burned. There is little use trying to check it by spraying when it becomes established, as the infestation is simultaneous and not progressive. Spraying is done to prevent rather than to cure black spot. Pick off all affected leaves from the plants and also those which may be on the ground, and keep the plants on the dry side until they get a clean start. Sprinkle a little air-slaked lime around and under the benches, and, with a bellows, apply air-slaked lime mixed with an equal quantity of Grape Dust, on the foliage.

ROSE RUST

This form of rust is mostly troublesome on Roses outdoors, on hardy hybrid varieties, but none is immune from it. All affected leaves should be collected in the Fall and burned and any affected wood cut away. Before growth commences in the Spring, spraying with a copper solution should be started, and kept up regularly until the growth has matured.

BLACK MILDEW

This is a disease which, fortunately, is little seen on Roses. It causes young, vigorous leaves to suddenly wilt and fall off, the young shoots will droop and die back and, if not checked, the whole plant will become affected. The spread of this disease is very rapid and whole houses are quickly ruined where it has gained a foothold. The general appearance of the foliage, when affected, is similar to that caused by a very bad dose of red spider. Sulphur, painted on the pipes strong enough to leave a deposit of sulphur on the plants, will eradicate this disease.

ROSE CANKER

This may be divided into two parts, and we will first consider this disease as found on plants which have been grafted or budded. The cause is an accumulation of food material at the junction of stock and cion induced by the unequal activity of the same. If the sap is flowing from the stock faster than the cion can use it, or if the opposite is the case, a moribund or hidebound condition of the tissues results, and canker or rupture supervenes. We have a very recent illustration of this in the Rose My Maryland and others, which do not always succeed well on Manetti. It is simply because some kinds do not hitch up well together, to use a homely phrase.

Another form of canker is found on outdoor Roses, commencing on wood of the second year's growth, in the form of red patches scattered over the bark. Sometimes little injury results from this other than the seamy appearance of the bark which, later, disappears in warm latitudes. But, where frost is common, the affected parts crack during the Winter. As the bark commences to grow over these cracks to heal the wound, the callus is affected with the disease, and large, rough outgrowths of callus are formed. All diseased branches should be removed, and the burned and spotted parts painted with creosote. Cabot's creosote is recommended for this purpose?

CHAPTER XII

INSECTICIDES AND FUNGICIDES

THERE are a number of proprietary articles on the market which are valuable for killing insect pests. When these are used the directions should be followed carefully, and, if in doubt as to the results, as with a new article, try it on a small scale at first. Where tobacco stems can be obtained cheaply they may be steeped in warm water and the liquid used when fresh as a spray. Use it full strength after first making a test on a small scale. Stems of tobacco may be burned when no flowers are being cut, but this is not recommended; it is dirty in its operation, makes a lot of work, and often does harm to the flowers. Tobacco dust may be used by burning, or by being dusted on the plants; it is a remedy for thrips, green fly, etc.

KEROSENE EMULSION

Is made by first shaving fine one pound of hard soap. Dissolve this in two gallons of boiling water, stir well, and while hot add four gallons of kerosene. Churn this well with a spray pump until an emulsion is secured; when this takes place it will be readily noticed. Dilute this stock mixture, when used, as the conditions require, adding at least ten parts of water to one part of the emulsion. This is a good spray for red spider, thrips, etc., and imparts a leathery texture to the foliage which some growers claim is mildew resisting.

HELLEBORE

May be dusted on the flower buds and foliage for thrips and kindred troubles. Apply this on the under side of the foliage when damp so it will adhere.

There are a number of poisons which may be used for killing insects, but their use is not often necessary and therefore is not recommended except in extreme cases. Mention has been made of Paris green and arsenate of lead in another chapter.

SULPHUR

Is too well known and commonly used to require much description. It is insoluble in water, but fusible with heat. When made into a paste and painted on steam pipes it is melted at once if the pipes are full of live steam. Large deposits of crude sulphur are found in certain parts of the world; after different processes of manufacture, which include distilling and sublimating, a fine yellow powder like flour is the result, which is commonly called Flowers of Sulphur. This should never be evaporated over a lamp or an oil stove, or over a fire of any description as, if it burns, a gas will be created which will take all the foliage off the plants. Place the quantity required in a small pail, add water to make a paste, and crush the lumps with the hand. Then add enough water to make a paint, which is easily applied to the steam pipes with a large paint brush. One pipe painted in a narrow house is enough, two or three will be required in the wider houses. A lump of lime may be added, when mixing, to help it stick on the pipes. Some growers make a paste of pure linseed oil and sulphur and paint this on the pipes, but this is unsightly and creates a bad odor; however, it saves sulphur and is lasting. Sulphur continuously applied to an iron pipe will eat it away in time sufficiently so as to impair its lasting qualities. It is best to always paint the same pipe and then, if damage is done, that particular pipe may in time be replaced. Dry sulphur may be dusted on the foliage with the bellows and allowed to stay on in the hot sun for a few days before being washed off.

SULPHIDE OF LIME

May be easily made with a peck of lime and ten pounds of sulphur. Place the lime in a half barrel, sprinkle with water, then with sulphur, until all is slaked. Do not use too much water at first or it will drown the lime, nor too little or it will burn it. Stir well, cover and let boil for two hours. Then fill with water, cover and let stand over night. In the morning a thin scum will be formed; take this off and throw it away. You will then have several gallons of clear, amber colored liquid. Bottle this up and use as required; for mildew on foliage using one part sulphide to thirty parts of water. After taking off the first lot of liquid you can fill up the barrel with water, stir well and proceed as before, when a second lot may be obtained. After this the refuse is good for whitewashing the bottoms of benches.

SULPHATE OF COPPER OR BLUE VITRIOL

Is found among veins of copper. It is manufactured on a large scale by being gently roasted. During this process dioxygen is absorbed from the air, the product is then dissolved in water and the remaining salts crystallized. It is used in Paris green, Bordeaux and other mixtures.

CARBONATE OF COPPER

Also used in spraying solutions, is the result of slow and various processes of refining, and is useful in fungous diseases.

CYANIDE OF POTASSIUM

Is used in forming the deadly hydrocyanic acid gas. This is not used by Rose growers as a general thing. The gas will kill any insect, scale, or animal life. Some writers claim that the cyanide (which looks innocent enough) will cause death through an unprotected wound in the hand or by simply inhal-

ing its vapors. This was probably the result of a fertile imagination, but withal it must be handled with great caution. The cyanide is permanent in dry air but is decomposed in moist air so that, when water is added, the deadly gas is quickly formed. To make sure of this, and to hasten the decomposition of the cyanide, sulphuric acid is added to the water. A small lump of the cyanide left exposed in a chest where seeds or specimens are kept, will be slowly decomposed by the moisture in the case, and give off enough gas to kill insect life.

Copper, sulphur, and lime are principally used in the various mixtures used for the spraying of trees. Soot is valuable on the foliage and on the ground as a preventive of fungous diseases, but must not be dusted near flowers, or it will disfigure them.



ROSE DOROTHY PERKINS

CHAPTER XIII

FERTILIZERS

COW MANURE THE BEST

AS fertilizing material in which to grow Roses there is nothing to beat good fresh cow manure, if properly applied; when thoroughly incorporated into the soil it is safe to use at any time. If used fresh, as a top dressing, it should always have a light covering of loam on top. It is not wise to mix lime with cow manure when used for top dressing; too much nitrogen is released at first when this is done, then it is either wasted or, if too strong, is liable to injure the plants. Manure from well fed dairy cows is best; the same from cows which are fed from the refuse of breweries should not be used, as it has been condemned by experiment stations as poisonous to Roses under glass. This fact does not seem to be generally understood. A case was called to my attention during the past Summer where a number of Roses were killed by this manure.

Good cow manure contains all the essential elements required in about the right proportion to produce good Roses, and some large growers who have tried various fertilizers have abandoned them all in favor of it. One grower went so far as to state that if a man cannot grow Roses with plenty of good cow manure at his command he had better give the attempt up; while there is a lot of truth in this, the statement may be modified somewhat for soils differ a great deal.

Rotted or partly decomposed cow manure is good but has lost a portion of its strength. Buy from a large barn to insure freshness.

BONEMEAL IS A GOOD FERTILIZER

Bonemeal is used principally as a top dressing and applied several times yearly as occasion requires. It is not necessary to mix it with the soil at planting time unless barnyard manure cannot be obtained, for good rich soil will carry the young stock along until September without any additional fertilizers. Bonemeal at thirty dollars or less per ton is not an expensive article, results considered. It is easy to apply and, if kept dry, may be stored and kept indefinitely. Scientists claim that it is a complete fertilizer, being rich in phosphates, limestone, mineral salts, etc. It is a lasting one and, for beds which are to be left for years undisturbed, might be used in a rougher form, mixed in the soil. For the quickest results bonemeal or flour is applied. It is important to obtain fresh ground raw meal if possible. Bones which have been subjected to a steaming process have lost a part of their value; bones which have been treated with acid to facilitate manufacture are condemned as injurious to plant life under glass. For Roses which show a tendency to make blind wood a light sprinkling of bonemeal will help produce flowers.

WOOD ASHES RICH IN POTASH

Wood ashes from good hard wood are especially good for Rose growing. They are rich in potash and lime and contain a fair amount of phosphoric acid, also a small amount of nitrogen. They are a good corrective of acid soils. They may be applied rather more frequently than bonemeal under general conditions. If the crop is off color wood ashes will improve it although the time to apply is when the growth is being made. A longer stem will then result from its use.

THE VALUE OF SOOT

Soot is one of the richest fertilizers known. It contains sulphuric, nitric and phosphoric acids, ammonia, potash, lime,



ROSE RED KILLARNEY

**Another very good sport from Killarney, not yet disseminated
Courtesy A. N. Pierson, Inc., Cromwell, Conn.**

etc., and may be obtained from the chimneys and boiler flues, but the burned out scrapings from boiler tubes are of no value. They should all be saved when cleaning out flues, etc., and stored away for use. Imported Scotch soot is a good article to buy and is a good fungicide as well as fertilizer. For a topdressing, mix soot with about twice its bulk of good fresh soil which will make less dirt when using it. Spread thinly on the bench, using about one bushel to 500 square feet of bench surface. For liquid feeding, mix with soft water, using one peck of soot to one hundred and twenty gallons of water. This may be enclosed in a bag with a string on the end and shaken around the tank occasionally. Apply this when the plants are growing. It will greatly increase the vigor of stems and foliage and improve the color of the flowers. As a preventive of fungous diseases soot has been found valuable under glass and outdoors. Dust over the foliage the same as sulphur. If used when the growth is being made, it can be well washed off before the flowers develop.

THE USES OF LIME

Lime is a fertilizer and sweetener of the soil that has been used for ages, not so much as a direct fertilizer but as an agent by which insoluble potash is changed into available food. It is possible to use too much lime, for then the soil is depleted of potash, and clay soils may be cemented by its exclusive use. Light sandy soils, as well as clay soils, are benefited by the use of lime. It should always be applied on top of the ground and lightly raked in as it will work downward.

Agricultural, or land lime, can be bought fairly cheap and is better to use than air slaked lime from the fact that the action of the carbonic acid of the air converts the lime into carbonate of lime (the form in which it existed before being burned). Hydrated lime, sold as land lime, is fresh burned lime slaked and pulverized by machinery. Less of this is required than

when air slaked lime is used. Numerous Government experiment stations have demonstrated the value of lime, and its value to florists has been clearly proved. A light sprinkling on top of the bench is all that is required. An easy test to determine whether lime is required is to take two tablespoonfuls of soil. Place them in two glasses, fill the glasses two-thirds full of water, add to one of the glasses three teaspoonfuls of dilute ammonia water (which may be obtained from any druggist), stir each glass with a separate spoon; if the one to which the ammonia water was not added shows an almost colorless liquid, while the one which did receive the ammonia shows a dark brown or black liquid, it may be concluded that lime would be of benefit, for the soil is more or less sour.

Perhaps a more common test is to place a few tablespoonfuls of soil in a glass and moisten with water to form a thick paste. A strip of blue litmus paper is then introduced; avoid touching with the fingers the end that is placed in the soil. The soil is parted with a knife and then pressed firmly about the paper. Having allowed it to stand at least half an hour, carefully remove the soil from around the paper. Then remove the paper and carefully rinse by dipping in water to a point just below where the soil reached. Do not dip or wet the paper above this point or the blue may be washed down to the lower part. If the blue has disappeared from the part where the soil was in contact and a red color has taken its place the soil will be benefited by lime for Rose growing.

OTHER FERTILIZING MATERIAL

Sheep manure is often used where cow manure cannot easily be obtained. It may be bought in bags, pulverized, and, applied fairly thick, is valuable. It is much more bulky than the articles previously mentioned and can be spread on four times as thick as bonemeal and similar articles.

Nitrate of soda will promote a rapid and soft growth. It should be used with care until you are thoroughly acquainted

with it. For liquid feeding use a small amount and note the results before going too far. If for a topdressing crush out all the lumps until it is very fine and mix with fresh, rather dry loam and spread thinly on the benches.

Sulphate of ammonia is used in much the same way as the nitrate of soda. Very quick results may be looked for when this is used. It will impart a very rich, dark color to the foliage of Roses and other plants. This and the nitrate may be bought in lots of anywhere between five pounds or as many tons.

There are other articles which may be used, but these cover the requirements of the average grower. They are all very valuable when used correctly and applied in the proper season, but, if improperly applied, serious results will follow.

The beginner had better pin his faith on good barnyard manure which contains all the essential elements generally needed and in about the right proportion for the plant's requirements.



CHAPTER XIV

THE AMERICAN BEAUTY ROSE

ITS CULTURE

GOOD American Beauty Roses are being grown in both even span and three-quarter span houses. A medium heavy loam, taken from good pasture land, and mixed with one-fifth cow manure, is best for their needs. They may be grown in the same house with other Roses ordinarily grown, but require more head room than other kinds.

HINTS ON PROPAGATION

When cutting off wood for propagation (and these Roses are grown on their own roots), pass by those plants whose foliage is at all off color, as these will be likely to lose their leaves before making roots, and, in such cases, are never so good for future use. Avoid also the extra strong growth which often runs to wood rather than the production of flowers. Select all the wood possible from plants which produce the most good flowers. Choose well ripened, short jointed wood, trying to select them all in the same degree of hardness that they may all root together and make an even lot. Then they may be all potted up quickly, and the results, of course, will be much better than when a batch is straggling along for weeks, as in this case some of them will lose their leaves.

The cuttings should have at least two eyes, and should not be crowded in the bench so that the leaves interlap or they will not dry after the frequent waterings or sprayings. Fungous diseases are likely to develop in this case. Avoid overwatering. Shade during the first two weeks, and then gradually expose to the full sunlight.

For early planting in May, cuttings should be rooted in December. January stock will be early enough for June planting. It is not profitable to plant American Beauty Roses from late rooted cuttings. The plants may be set out in solid beds or on benches in the same depth of loam as is used for Hybrid Teas, and they may be planted about the same distance apart. From sixteen to eighteen inches apart is a good distance, although some growers do not allow them quite so much room, planting two inches closer. This refers to the distance apart in the row. The number of rows in a bench is the same as for Killarney and similar varieties. It is not wise to plant anything but the best stock for the results will be unsatisfactory if you do.

After planting in the early Summer, when evaporation is so rapid, frequent damping down and spraying will be required. As soon as the plants get established this should be reduced as much as possible or a very soft growth will be induced which will make trouble later on, and will make the stock an easy prey to diseases of all kinds. One good syringing daily, after the first three weeks or so, will be enough. Early stock, flowering in the Summer months, may have a fair top-dressing of rich manure and will require liberal watering at the roots.

To avoid any check to the plants it is best to pinch out a part of the buds and only allow the best to mature on the young stock. After cutting away wood care has to be used in watering until the plants are again in active growth. Toward Fall great care must be taken in the use of water both on the foliage and at the root, or black spot will be likely to gain a foothold. Aim to have the foliage dry by evening. Keep the benches and walks clean and free from rubbish, and the walks free from standing water, but not dust dry. Do not allow the beds to get dust dry before watering, but when they are on the



ROSE AMERICAN BEAUTY

Universally popular and where it can be successfully grown is
most profitable

Courtesy A. N. Pierson, Inc., Cromwell, Conn.

dry side give a moderate amount of liquid manure during the growing season, alternating this occasionally with clear water as the plants require. Avoid any conditions in the house which will cause drip. Keep a little steam and air on every night and stormy day, and spray with a copper solution about every ten days if there is any tendency to black spot; if this latter shows up it must be faithfully picked off and burned.

Old plants may be cut back and replanted after being dried off a little. Replant in good new loam, give a fair watering, and then spray the tops occasionally to cause the young shoots to break well and come strong. Then, as the plants advance and take hold of the soil, more water at the root may be given. Old plants may be dried off a couple of weeks and then pruned and started up the same as the Hybrid Teas. Yellowing of the foliage is the common result of this operation caused by over-watering. A good plan is to water the beds after scraping off the old loam. Then, after the topdressing, no more water is given, as the moisture received is sufficient to keep them going until they are well started into growth. Then they may receive a careful watering.

American Beauty Roses, grafted on Manetti, are the best for carrying over and starting up in this way, is the report of Mr. Alexander Montgomery, as there is not the same danger of yellowing, but otherwise there is no advantage in grafting this variety.

The Winter treatment is much the same as for other Roses; 60 degrees to 62 degrees is a good night temperature. So long as the tops look red you can be reasonably sure that you will get a flower. In the vicinity of Philadelphia they say that, if the buds are formed by Thanksgiving, they will be in time for Christmas. In the neighborhood of Boston it takes about ten days longer. About six weeks is required, generally speaking. No two places or seasons will be exactly alike. Careful watch must be kept for thrips. If this gets a foothold, it will very

soon do a lot of damage. Tobacco stems, burned often enough, will destroy it and will not hurt the plants, but care must be used in fumigating when the buds show color or the flowers will be damaged. Up to that time tobacco smoke, reasonably applied, will not hurt them.



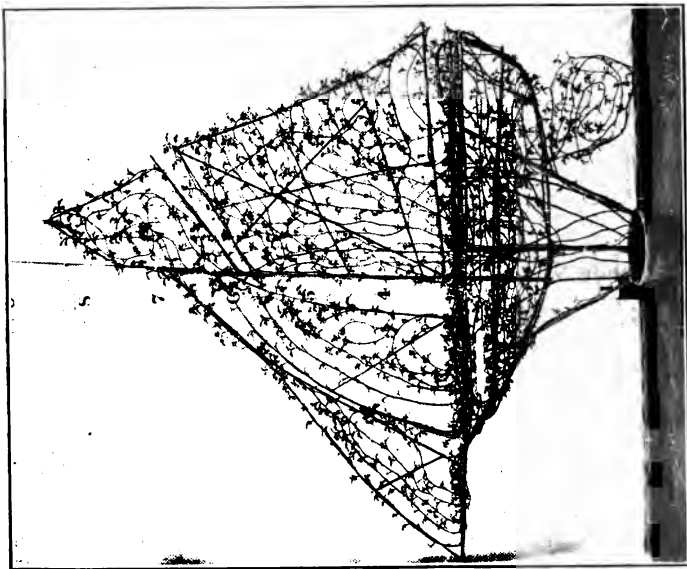
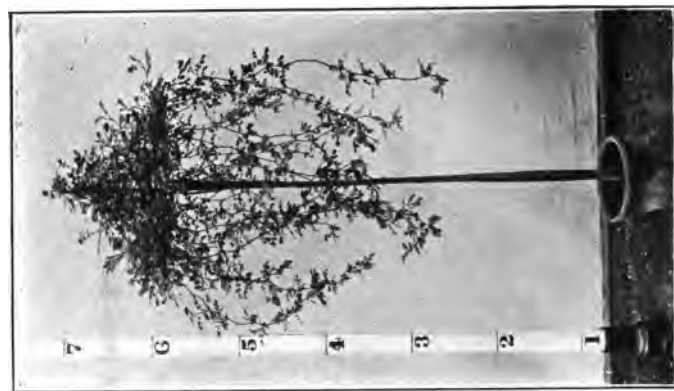
ROSE DOUBLE RUGOSA

CHAPTER XV

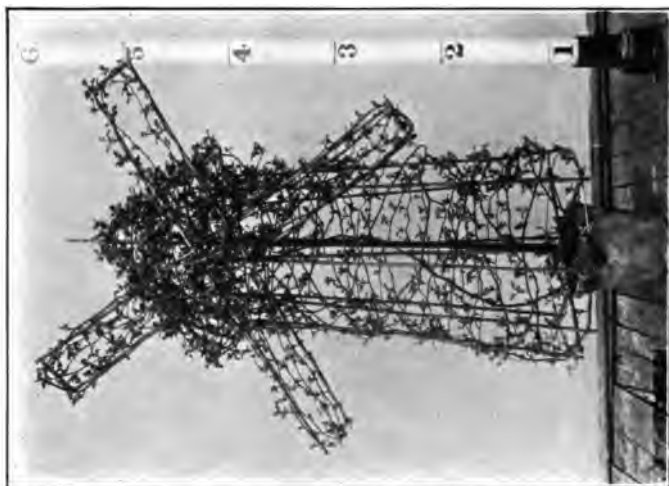
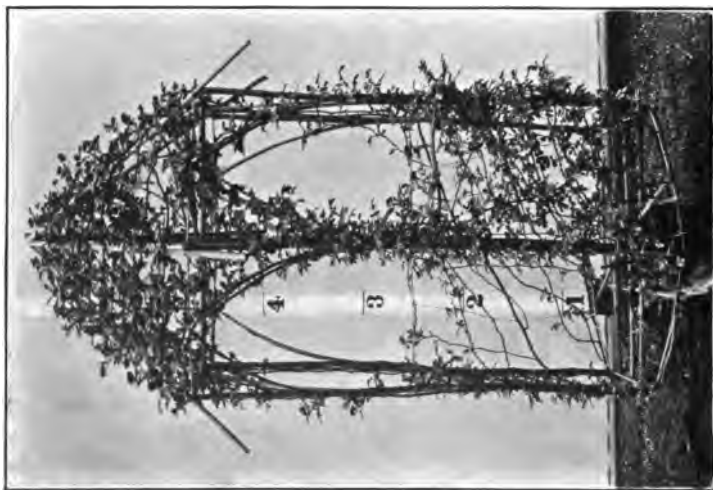
RAMBLER ROSES

THIS class of Roses has come into great prominence during the past few years, and, thanks chiefly to American hybridizers, we now have a large and varied collection of good kinds, suitable for outdoor planting, and good also to force for Easter and Spring sales. In addition, we have the dwarf, or Baby Ramblers, which are excellent for bedding outdoors. These are very desirable and will flower all Summer. Among the best of these are crimson, pink, and white. Baby Dorothy is a good pink. One of the newer ones, Jessie, originated by Merryweather of Southwell, England, is described as one of the best, commencing to bloom in June and continuing until killed by frost. These grow to a height of about 2½ feet. branch freely, have bright, glossy green foliage and flowers of a bright cherry crimson color, borne in large clusters. These dwarf Ramblers are a decided acquisition, and add charm and variety to any Rose or flower garden.

Among the Climbers, or Ramblers proper, some of the best are, first, the original and reliable Crimson Rambler; Philadelphia Rambler, similar to the former, with brighter and larger flowers; Dorothy Perkins, a beautiful shell pink; White Dorothy, a sport from the pink; Debutante, light pink; Hiawatha, crimson; Lady Gay, cherry pink; Yellow Rambler; American Pillar, a valuable Climber with single rosy pink flowers, and a kind possessing a vigorous constitution. This Rose has been used successfully on embankments and, in addition to other good qualities, has splendid foliage and grows freely.



METHODS OF TRAINING RAMBLER ROSES
Courtesy Thos. Rochford & Sons, Broxbourne, England



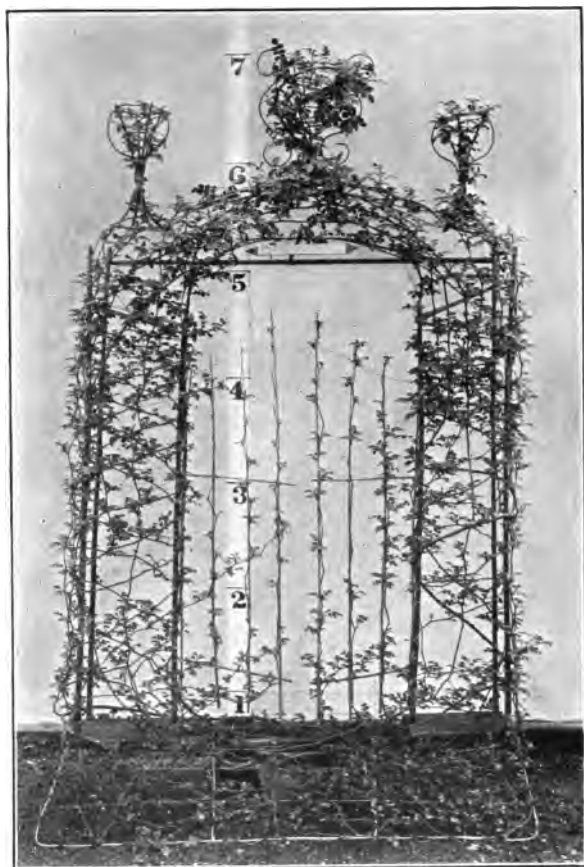
METHODS OF TRAINING RAMBLER ROSES

Courtesy Thos. Rochford & Sons, Broxbourne, England

Stock of these Roses may be bought from any nurseryman or may be raised at home.

To gain time when propagating Ramblers, cuttings of half ripened wood may be inserted in the late Summer in a hotbed, potted up as soon as rooted and grown on in the greenhouse. These will have quite a start over the Spring rooted stock. The Spring stock may be obtained by taking cuttings from plants started into growth inside after New Year. Some growers of forced Ramblers allow one or two strong canes to start and, by pinching these, a number of good cuttings may be obtained. These are rooted in the sand and grown on in the usual manner. They may be planted outdoors in good ground and should be carefully cultivated to get the best results. This Spring rooted stock will not make very large plants the first year. The Fall rooted would have the advantage here, but either kind could be used as small stock for forcing.

By leaving the plants out two or three years, large plants may be obtained. In this case it would be wise the first year or two to shorten back the canes to produce a bushy growth; the last year the long growths should be tied up to stakes, or to a fence, to allow the wood to thoroughly ripen, which is essential to success in forcing Ramblers. Plants dug up from the field in the Fall have been potted and forced with good results, cases being on record where the percentage of failure with this stock was very small. A great deal depends, however, on where the stock is obtained and the condition it is in when received. It is generally agreed that pot grown stock is the most reliable and gives the best results. In this case stock may be dug from the field and potted in the Spring, grown on inside for a time and may then be plunged outside in coal ashes. They should be well fed and watered all through the growing season and receive all the sun and air possible. Withhold water gradually in the Fall and, if heavy



METHOD OF TRAINING RAMBLER ROSES

Courtesy Thos. Rochford & Sons, Broxbourne, England



METHODS OF TRAINING RAMBLER ROSES

Courtesy Thos. Rochford & Sons, Broxbourne, England

rains occur, lay the pots on their sides to prevent the plants becoming too wet and starting into growth. When wintry weather occurs the plants may be stored in a frame until time to force. This will be about the first of January, depending somewhat on the date of Easter, which is the time when large quantities are disposed of.

It takes about ten or twelve weeks from the time they are brought inside until they are ready for sale, depending on how they are ripened, established, the heat applied, etc. As soon as the plants are brought inside the long canes should be tied into the shape desired. Wire stakes are very useful for this purpose as they may be bent into any shape and, when covered with foliage and flowers are not noticeable.

The illustrations given in this chapter show the methods of training employed by an English grower which vary little from our own. The temperature at first should not exceed 45° at night. Water should be applied moderately at first; after the balls are once wet to the bottom, syringe the plants several times daily to help start the buds. The object is to get all the buds started and all to flower, or the fine effect of the trained specimen is lost. After two or three weeks the temperature may be raised to 50°. Later, when the buds are formed, to 55°, and finally to 60°.

It should be remembered that a little extra heat may be applied to hurry them along if late, or they may be slightly retarded if too early. The ones grown in moderate heat will be the best and will keep the longest. No forcing should be attempted until after the buds are formed.

The treatment during the forcing period is much the same as that required by other Roses. Air carefully; feed and water freely during the growing period; harden off gradually before sending to market, but never leave in a dark, draughty place. It will take one month from the time the flower is formed until its development.



ROSE CLIMBING AMERICAN BEAUTY

No garden is complete without this splendid variety

Originators, Hoopes, Bro. & Thomas Co., West Chester, Pa.



ROSE BABY RAMBLER IN POT

A gem for forcing or bedding. Try a bed instead of using
tender plants

The Baby, or Dwarf Ramblers, may be forced in the same way as the others. As these flower all Summer, and may be sold at almost any time, they do not require such careful timing as the Climbers to get into flower. Houses that are not quite the best, work in well for these Roses the first six weeks, when they may be moved into the flowering house. Most plant growers have a number of small houses which allow of constant changing around of stock as some have to be hurried and others held back.

The best demand for large forced Ramblers is at Easter. For the smaller and cheaper plants there is an excellent sale all through the Spring months and especially for Memorial Day.

All plants left over from Spring sales may be grown on through the Summer and will make good plants for the following year. Unless they were potted in early Spring they will probably need repotting in good rich loam. This may be done right after flowering and the plants grown on in the usual manner. Or these same plants may be used for outdoor planting with the advantage of being safely transferred and planted at any time during the Summer. Besides the varieties mentioned at the commencement of this chapter, there are a number of others that are good, and new kinds are constantly appearing, making this class a most interesting and useful one.

CHAPTER XVI

ROSES OUTDOORS

IN choosing a location for Roses outside an exposure from southeast to southwest makes an ideal garden. The early morning sun is of greatest value as most of their growth outdoors is made before 8 a.m. every day. Shelter from the north and east or west, whichever way strong winds may blow from, according to location, is necessary for the best results; the main point is that the plants should be exposed to the full sunlight.

The ground should be rich and well drained. If the soil is of a cold and clayey nature, plenty of good horse manure, well worked in, will be of advantage. For ordinary soil nothing is better than cow manure. The land should be well cultivated and in good condition to receive any crop before planting Roses. These plants are gross feeders and, after they become established, will be benefited by applications of manure water in the growing and flowering season, and by topdressings of manure. Hoeing and cultivating will have to be attended to, and all weeds and insect pests kept down. These conditions observed, an abundance of good blooms will be the result. It is remarkable how Roses will exist and blossom even where neglected, but when proper care is given there is no flower that responds more readily to the attention given it.

There is no secret in the growing of good Roses. The proper location, rich, well drained and well cultivated soil, and safeguarding against fungus and insect pests, will all contribute to the health and vigor of the plants.

Roses may be planted in rows three feet apart and eighteen inches apart in the row. If cramped for room they may be



ROSE ULRICH BRUNNER
Fine cherry red. Good for forcing or outdoor culture

set closer, but should never be planted so close together as to interfere with cultivating or with their proper development. As early in the Spring as the ground can be worked is the best time to plant, although the plants may be set out up to the first of June with fair success. I once saw a lot of imported stock delayed in shipment, planted out the last week in May which, thanks to a cold June, did remarkably well.

For late planting plants from pots or benches can be relied upon for good results, or plants may be set out in the Fall.

Roses on their own roots may be planted just below the surface of the ground, but grafted stock should be set out two or three inches below the graft. Hybrid Teas from under glass may be planted out at any time in the Summer. These delight in a warm, dry soil, unlike the heavier and moister soil required for Hybrid Perpetuals. If the stock taken from the benches is cut down halfway, or even lower, it will break strongly and give good flowers during the Summer. Never allow any stock to lie around so that the roots become dry before being planted; if at all dry, soak the roots and prune off any broken ones before planting. Tread down firmly, after planting, and cultivate to keep the ground from caking on the top. The spring work will consist of, first

PRUNING

This is generally done in the Spring in latitudes where the plants are dormant all Winter. The weak growing varieties should be pruned to three or four eyes from the ground, but the strong growing kinds may be left twice that length. The harder they are cut back the more vigorous will be the new wood and the larger the flowers on the Hybrid Perpetuals.

Varieties like the Banksia, Crimson Rambler, and others which flower from the shoots produced the previous year, require little pruning. They may require to be shortened back a little, but, if cut down, they will produce an abundance of

strong new wood but no flowers. Any pruning necessary on these is best done right after flowering.

The Hybrid Teas may be pruned about the same as the hardy garden kinds outdoors, but not cut back so hard.

If any strong shoots come up from below the graft they must be rooted out or they will in time destroy the upper part of the plant. This is the wild stock and grows strong, is rather red when young, has more thorns than the other kinds as a rule, and has seven leaf stalks, while the cultivated kinds have mostly five, although under glass, growing very luxuriantly, we have seen them with seven and also with nine leaf stalks. In any case they will look foreign to the rest of the plant. If they come from below the graft there is no doubt of what they are.

Such varieties as Bridesmaid, Richmond, Madame Abel Chatenay, Killarney, and others, have been safely Wintered outdoors in the New England States. Wm. R. Smith, My Maryland, Wellesley and Mme. Caroline Testout do splendidly out of doors. Killarney mildews badly outdoors in some places.

When pruning outdoor Roses keep a sharp lookout for any disease; and if any is found at once apply the remedy. Pick up or rake off all clippings and take off any Winter covering and commence the stirring of the soil as soon as needed.

SPRAYING ROSES OUTDOORS

Spray for insect pests and fungous diseases, if any have been noted. Whale oil soap, or Ivory soap, one pound to eight gallons of water, makes a good spray for green fly, or it may be dislodged with the hose if the water pressure is great enough. For the leaf roller, dust hellebore on when the foliage is damp, and, if washed off by rain, repeat the application; or spray with Paris green, using a weak solution when the foliage is young and tender. For thrips dust hellebore on the under

side of the leaves, when wet; these pests attack the plants in a hot dry time and a thorough drenching of the plants and soil will help drive them away. Hand picking will have to be resorted to for Rose bugs and grubs of all descriptions. For mildew dust with sulphur, and spray in the Spring and Fall with the sulphide of lime described in Chapter XII.

Always make a test of all spraying materials on a few bushes if the exact strength is not known. For rust, the spraying may be done with a copper solution.

To obtain good flowers, disbudding must be practiced as soon as the buds are large enough to be taken off. If the weather is hot and dry at this time, the crop will be much improved by mulching and copious watering with both clear and manure water. If no mulch is applied, stir the ground frequently so as not to allow it to cake. If any suckers appear on the grafted or budded plants they should be rooted out.

OTHER POINTERS

In the Fall, all dead leaves and rubbish should be cleaned up and burned. In this way a lot of trouble will be saved the following Spring. Climbing Roses, or tall growing varieties, should be securely fastened so that they will not get broken during the Winter storms.

During the first half of November the soil may be hilled or drawn up to the plants to the height of eight or nine inches and the space between the rows filled in with manure. This will protect enough of the lower part of the plant so that if the tops Winter kill, there will be enough remaining to produce strong breaks.

Tender varieties should have pine needles or coarse hay placed among the bushes which may, in turn, be covered by some evergreen branches to keep away strong winds or sun. The strong sun in early Spring, combined with zero nights, is harmful to Roses.



TEA ROSE WHITE MAMAN COCHET

A splendid garden Rose. Free habit and good blooming qualities

If field mice are abundant, they sometimes work havoc with the bark underneath the covering. For this reason earth alone is the best and often is all the covering required. Pine needles make the next best covering for the same reason.

After removing the covering in the Spring, the earth may be levelled down in the rows, leaving it a little higher than it was the previous season.

A bed of Roses will produce good flowers for a lifetime if it is closely pruned every year, and if the plants are dug up and root pruned every seven or eight years.

CLIMBING ROSES

These varieties have within the past ten years, made great strides in popularity. Since the advent of the Crimson Rambler and its successors, these have come into the front rank and they are worthy of the position that they hold. These may be used in a variety of places and do well even on north walls, but they are prone to mildew if planted in draughty or shady places as we often see them on the sides of houses.

These flower about the first week in July, thereby prolonging the season several weeks, and very fine effects may be produced with them. Their culture is the same as for ordinary garden Roses, except that they require little pruning. There are a number of these Roses worthy of a place in every garden and, by consulting the growers' catalogues, a variety of colors will be found.

IN THE HYBRID TEAS

Wellesley is said to excel outdoors. There are almost a score of good ones. In addition to the ones previously mentioned in this chapter we have La France, Caroline Testout, Madame Cochet, white and pink, Kaiserin Augusta Victoria, President Carnot and others.

CHAPTER XVII

COST OF EQUIPMENT AND RETURNS

COST OF BUILDING AND EQUIPMENT

THE cost of commencing as a wholesale or retail Rose grower depends somewhat on circumstances and style of houses. Good, serviceable houses of the proper type will probably cost, when planted and completely installed, in the neighborhood of \$7,500.00 for every 10,000 square feet of ground enclosed.

Allowing about one-third of this enclosure for walks, we have ground left which would hold probably 6,000 plants, depending somewhat on how the house was laid out and how close together the plants were set. If these plants produce an income of one dollar each per year, they are doing well. A great many growers get less, but this amount and more has been obtained.

A Rose plant, doing well, will produce about fifty flowers per year. Some growers get an average of three cents per flower the year round. I have on record the cut of one establishment where My Maryland produced, from young stock planted in May, 1909, an average cut of sixty-five flowers per plant for the twelve months ending July first, 1910. The cut in December and January, combined, amounted to nearly four thousand flowers. The Killarneys will average as well for the year and may be more easily manipulated by the small grower so that they will produce a larger percentage in the Winter time. It seems unnecessary to mention varieties. There are at least a dozen that do better with some growers than they do with others.

The cost of operating also depends largely on the owner or manager. Labor and coal are the principal items. After you have figured these, you must add a reasonable amount for incidentals and other expenses, all of which multiply at an alarming rate. Taxes, interest, depreciation of stock, etc., all have to be considered before you can count the profit. But, after all, Rose growing is a profitable business if it is properly carried on. If you cannot do it right it is the wisest plan to let it alone.

In addition to the revenue derived from the ordinary sales of cut flowers and plants (and the old plants from the benches may sometimes be turned into a little cash at replanting time), there is the possibility of a plant sporting on your place which, if it is an improvement over existing varieties, may prove of value. In this case, watch it carefully for a couple of years to make sure it is a good thing. Propagate a good stock from the best wood and sell it as soon as you can get a good offer from a reliable firm unless you have the facilities for growing and shipping young plants yourself. You will probably be better off in the end if you pursue the former method, for the cost of sending out a new variety is considerable. In any event, avoid keeping a sport too long as there is always the possibility of another grower having one as good as yours and getting it on the market ahead of you.

POISONING WITH FERTILIZERS AND INSECTICIDES

There has often been a cry raised that growers are using dangerous chemicals on their bushes as fertilizers or insecticides. People handling flowers in the markets and in stores have had badly swollen hands and arms at times and the growers have been blamed for it. I never believed that this was right and have asked several doctors who quite agree with me. Presumably healthy people have died before through the prick of a

pin, the scratch from a nail, and from other apparently insignificant causes.

The trouble with Roses is that the thorns prick and break the skin. If, at this time, there is any dirt or impurity on a person's hand, as is often the case when engaged in his work, these impurities enter the blood, and serious results may shortly follow, especially at certain seasons of the year when particular subjects may be more readily inoculated. I do not know of a single case where the trouble can be traced to anything the grower used no matter what has been said to the contrary. Growers are very careful in this matter and poisonous compounds are used but little under glass in general practice.



COMMERCIAL ROSE PACKING

Box of Chatenay and Killarney Roses packed by Robert Simpson,
Clifton, N. J., and consigned to Traendly & Schenck,
131-133 West 28th St., N. Y. City.

CHAPTER XVIII

NOTES ON CUTTING, MARKETING, EXHIBITING, ETC.

CUTTING

IN the hot Summer months Roses should be cut early in the morning and placed at once in fresh, cool water, in a cool, dark room. After remaining there for a reasonable length of time they may be assorted into the different grades required and are ready for shipment to market. The sooner they are sold after being properly cooled off, the better will be the results. Twenty-four hours is as long as they should be kept, although they may be and often are kept much longer, for various reasons.

In the Winter time it is best to allow the flowers to remain longer on the plants before being cut as they develop very slowly, especially in cold, dark weather. They make a much better appearance when being sold if they are not cut too soon in Winter, but as the hot Spring and Summer sun advances it is necessary to cut early in the morning and again carefully in the late afternoon.

GRADING

When grading, care must be taken to assort carefully and to put nothing but the best in the higher grades. Fine foliage, long stems, and other good points count for nothing if the flower is deformed or off color. Every part must be perfect. Keep everything true to grade and see that the count is always correct, and you will build up a reputation for right dealing which will be worth much in getting and holding the best

trade. There is always a market for the right goods. It is true that at times prices are low, but it is also true that a good salesman can nearly always find an outlet for good stock. Prices for the shorter grades are as good sometimes in August as they are at Christmas, because of the fact that everybody is growing immense quantities of all kinds of flowers for the Christmas trade and the market is glutted if anything happens to unbalance things, such as bad weather, hard times, etc., while, on the other hand, there is always a shortage in August, which is between seasons in a measure. The June glut is past. Some growers, disgusted with their returns, have ceased shipping and are drying off their stock, while the man with a few good Roses can make a few dollars very easily.

MARKETING

The flowers should be laid out carefully and evenly, on stout wax paper, which may be bought ready cut into convenient sizes (15 in. by 20 in. is a good size for ordinary grades). For longer stems, a double sheet of newspaper may be laid underneath the wax paper. A little chopped ice should be sprinkled on the foliage of every bunch if the weather is warm or they have to travel far. The finer the ice is chopped up the better will be the results obtained. Keep the flowers dry and cover with tissue paper. Lay on the papers and place in the boxes in such a manner that the heads cannot get broken, and always lay the white flowers on the top (or as much as possible) as they are the most likely to get bruised and discolored. Line the boxes carefully with clean paper and use boxes of a uniform size and not over eight inches deep.

By visiting the markets and making a few notes of the way Roses are shipped in you will soon see how the packing should be done, and you will find that the growers who ship in the best manner invariably get the most satisfactory results. It pays in the Spring months to double the number of shipments to

1911

RECORD OF DAILY CUT

(Tack this on a board and hang up in the Greenhouse)

Month _____ House No. _____

	Richmond	My Maryland	Laiseria	Killarney	Am. Beauty	Other Vars.	TOTAL
1	75						
2	56						
3	110						
4	84						
5	97						
6	69						
7							
8							
9							
10							
11							
12							
13							
14							
15							
16							
17							
18							
19							
20							
21							
22							
23							
24							
25							
26							
27							
28							
29							
30	120						
31	75						
Total	668						

These Record Sheets in blank form, printed on medium cardboard, to size 11x14 inches, may be obtained from the publishers of this book. Price, 75 cents per dozen.

SALES SHEET FOR OFFICE

Month _____ Year _____

The first column under each grade indicates the quantity sold. The second column, *which may be in red ink*, shows the price obtained each day.

K I L L A R N E Y								
	SPECIAL		No. 1		No. 2		No. 3	
1	25	\$3.00	25	\$2.50	50	\$3.00	100	\$4.00
2			50	5.00	75	4.50	75	3.00
3	25	3.00	50	5.00	50	4.00	150	6.00
4	25	3.00	50	5.00	50	4.00	100	4.00
5	25	4.00	25	2.50	50	4.00	125	5.00
6			50	5.00	75	4.50	150	6.00
7								
8								
9								
10								
11								
12								
13								
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25								
26								
27								
28								
29								
30								
31	25	5.00	50	6.00	75	5.00	100	5.00
Total	125	\$18.00	300	\$31.00	425	\$29.00	800	\$33.00

These Sales Sheets, in blank form, may be obtained from the publishers of this book. They are printed in pads of 100, on good writing paper; size of sheet, 11 inches long, 5½ inches wide. Each sheet covers one month's record for one variety.
Price, per pad, 60 cents, postpaid.

insure fresh goods. It is also found advantageous, when grading certain kinds, to have the feet and inches marked off on the table so that you can tell at a glance how long the stems are; customers often want to know this point when ordering. To get the best prices the market must be closely watched and followed up every day. The men with the steady supply are the ones who will be looked to for the goods, and these men can sell Roses at all times.

PREPARATION FOR EXHIBITION

Roses intended for the exhibition table are often taken from the ordinary cut intended for market, but, if especially large and fine flowers are desired, a little extra care should be given. Extra good shoots should be picked out and marked by tying a piece of string or raffia on them. They should then receive special attention as regards food and water, and should be cut so that they will be in the best condition possible when they are exhibited. If they are rather late in flowering they may be hurried along with extra heat, but they are never so good in this case as they are likely to be soft and so wilt. It is preferable to have them a few days early. They may be cut one week ahead when in the bud and placed away in a cold room in clean water. If you have no ice chest it is advisable to set the jars in a bank of snow or on ice in your flower room if it is at all warm. This will retard them. They will require careful watching every day as they must be developed enough to make a good show and at the same time not be past their best. A few undeveloped or old flowers will spoil the entire bunch.

When staged the general effect should be good. This is most important of all, and if, on close inspection, it is found that the quality is there and the details are correct, the exhibit will be very likely to favorably impress both judges and public.

NIGHT TEMPERATURE RECORD

TO BE FILLED IN BY WATCHMAN

Month of 191 House No. East or West

Time	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
6 P. M.	60																														
7	60																														
8	59																														
9	59																														
10	59																														
11	59																														
12	59																														
1 A. M.	59																														
2	58																														
3	58																														
4	58																														
5	59																														
6	60																														

These Temperature Records, for day or night use, may be obtained from the publishers of this book. They are sold in pads of 100, printed on serviceable paper. Size of sheet, $8\frac{1}{2}$ inches deep by 11 inches wide. Price, 50 cents per pad, postpaid.

CHAPTER XIX

GENERAL REMARKS

EXAMINE NEW STOCK CAREFULLY

WHEN buying new stock it should always be examined on arrival and quarantined if any sign of disease is found on it. Complaint should be made at once, if any is in order; it is useless to wait several weeks or months before doing this.

HYBRIDS FOR FORCING IN POTS OR BOXES

Roses to be flowered in pots will give better results if they are carefully grown in them the previous Summer so as to become established; they should then be dried off. The earlier they are rested the sooner they can be forced. The main point to be obtained is strong wood well ripened the previous Summer.

Prune as advised in a previous chapter.

Tie the Rambler type into the shape required as soon as possible after they are brought in for forcing.

It will take twelve or fourteen weeks in Midwinter to bring these varieties into flower from the time they are brought into heat. Start cool at first, spray to induce a good break, and feed liberally as they advance.

When Easter comes rather late, Crimson Ramblers may be forced in ten weeks.

Allow a temperature of about 45 degrees at night at first, raising this to 58 degrees later, after the buds have started and the flower buds show. A little extra warmth may be allowed at night after this, if necessary, as it is not so injurious in the Spring months, but undue forcing is not recommended at any

time for Roses; 60 degrees at night, and 75 degrees at noon on sunny days in Winter, is as warm as Roses should be kept, excepting special kinds. During spells of cold, dark weather, the temperature may be reduced from four to eight degrees in the daytime and from two to four degrees at night.

Hybrid Teas may be lifted from benches and stored over Winter in a frame out of the reach of standing water. Set close together, sift fine loam over the roots, and protect from frost. Give air at intervals and look out for mice among the coverings. This stock may be replanted inside or planted outdoors early in the Spring where it will give good results.

Roses in pots may be wintered in the same way. Bring in as required for forcing. Give thorough soakings of water to wet the ball through to the bottom when pot Roses are brought inside for forcing.

EEL WORMS DO NOT HURT MANETTI STOCK

Root galls or eel worms were responsible in a great measure for the introduction of the now common method of growing Roses on Manetti. They do not seem to hurt this stock, when present, as it grows so rapidly. They are seldom seen on Manetti roots. Soil sterilization is the best remedy for eel worms; some use lime water, others use loam from wet land for planting. Never hurts Roses on Manetti or plants in solid beds. Occurs generally on benches.

American grown Manetti stock has been tried for grafting purposes but, up to date, does not compete successfully with the imported product. The wood is too dry and wiry when grown in this climate.

AMERICAN HYBRIDIZERS HAVE DONE GREAT WORK

As before stated, the raising of seedling Roses is expensive and cannot be undertaken by the average grower. We have worthy men who are doing good work for which they deserve

much credit. The American grower looks to such men as E. G. Hill, Alexander Montgomery, John Cook of Baltimore, raiser of My Maryland, and others for a race of plants which will fill all the requirements of our exacting methods of cultivation and marketing.

THE ART OF WATERING

One of the arts of growing good Roses lies in knowing when and in what quantities to apply water. In Winter time, from about November 1 to February 1, it is best to water rather light and carefully, allowing the beds to become a little on the dry side before giving more water. Water most freely when a new growth is being made, then reduce the quantity when the crop is almost off. At certain times in Spring and Summer it is almost impossible to give too much water. Soak the beds thoroughly when starting up new after drying off in the Summer time. By drying off I mean reducing the water supply, not the old-fashioned way of drying the beds so that they crack open. It will do no harm to repeat: do not dry too much. One month is long enough to dry off in the Summer time.

If the loam is sour, heavy waterings will sometimes help to sweeten it. If the loam becomes filled with an accumulation of poisonous salts from excessive feeding with fertilizers, it has been recommended to water very heavily, allowing the water to run copiously through the bottom of the bench. This may be kept up for several hours.

Never attempt to grow Roses on a bench without proper drainage. If the water will not pass through easily, rebuild the bottom.

Never water heavily at the commencement of a spell of dark, cold weather in Winter. Generally speaking, any water fit for drinking or washing purposes is good for growing Roses; the nearer it approaches to rain water the better it is.



PINK KILLARNEY ROSE

No two flowers look alike when they are Killarney
Courtesy A. N. Pierson, Inc., Cromwell, Conn.

Water for agricultural purposes is valuable according to its solvent properties. That is, the more able it is to convert the latent fertility of the soil, or manure applied, into available food for the plant, the more we esteem it. The air being full of carbonic acid, which impregnates the rain water as it falls, causes the softness. This is more marked in severe weather as the carbonic acid is more soluble in cold rain and snow. When passing through the soil, the water performs its work; and then some portion of it finds its way down through iron, chalk, limestone, or whatever is underground, and the water becomes contaminated, and often contains inorganic salts in solution.

Salts of lime often exists in large quantities where chalk and limestone are found. This water, which is the kind often obtained from wells and which curdles soap when washing, is not so good for plants, and is bad for the boilers and the heating plant, as it encrusts them, owing to the precipitation of the carbonate of lime in the boiling process.

ADVANTAGE OF FALL COLLECTION OF LOAM

Many good growers collect their loam in the Fall and stack it together for the following reasons: much time is saved in the Spring and it is sometimes impossible to get on to certain fields until the ground dries late in the season. Other growers claim that they never have any grubs in the very dry loam collected in the Fall.

Where grafted Roses become partly separated from the stock they will look half dead for a time, but often make roots of their own, if left alone, when they will pick up again and grow well. A little loam or old manure banked up around the bottom will induce them to make roots where they are being separated from the stock.

TRY A FEW PLANTS IN SHALLOW LOAM ON BENCHES

The time-honored custom is to repot young Roses into larger pots as required, but several large growers have adopted



ROSE GRUSS AN TEPLITZ

Bears large clusters of brilliant Roses. A fine variety outdoors

the custom of taking them out of the small pots and planting them five or six inches apart on shallow benches, where they remain until they are placed in their permanent quarters. They make fine plants in this way and will lift without being damaged if kept a little on the dry side. One grower claims to have planted six weeks later this year than he did last and to have cut flowers six weeks earlier, and that only nine weeks elapsed between the time of planting and cutting the first crop.

ROSES THAT PAY, AND WHY

The My Maryland Rose has been credited with earning \$1.50 per plant per year by one large grower. Another variety has earned \$2.00 per plant in a year. But these are exceptional cases. Where it can be successfully grown there is no doubt that American Beauty pays as well or better than any other Rose. The first year 1,000 plants of a new thing may pay \$2.00 per plant. Two years later 5,000 or 10,000 plants of this variety may not pay more than half as much per plant per year. The first man in the field gets the best results.

WHAT NUMBER OF ROSES CAN A MAN TAKE CARE OF?

On large places a section man will take care of from 4000 to 6000 plants. This depends on conditions. Cheap help is given to clean the houses, etc., on some places. These men have their regular work caring for the plants and cutting the flowers, and often do not see the flowers after they leave the houses, the grading and shipping being done by separate men. The firing, also, is done by regular firemen, one or more through the daytime and the same for the night work, in addition to watchmen who go regularly through the houses and attend to the temperature.

A POOR MAN CANNOT TAKE CHANCES

After a man becomes established and is in a position to experiment a little it is well to try a few of the new varieties.

Take all the new kinds and try a few of each. If you find a good one, grow one or two thousand of it the next year, but never go into an uncertain thing too heavily. You must have enough of the sure things on the place to make good any loss you may sustain over the others. On large places an order for 10,000 plants of a new kind is not uncommon.

A man must take some risk if he is anxious to make money, or to try new kinds, and the novelties are always sought by the buyers and often help to sell the common stock.

In choosing a good Rose for Winter flowering you will find that varieties with a rather long, pointed bud, will develop best in the dark days. Buds hard and short, like a flat cabbage head, are best in the Summer time. Take two good buds about ready to open and feel the difference; the former kind, having perhaps thirty petals, will feel soft and yielding to the touch, while the latter, with forty-five petals, will be very hard and slow to open.

ALWAYS BE PREPARED FOR BAD WEATHER

The need of fire heat in the Fall depends somewhat on circumstances. If the plants are not soft, and if the houses are not over-charged with moisture, no harm will result from one or two cool nights without fire in August. On the other hand, the seeds of disease are often sown at this time and the good grower is always prepared to turn on steam at short notice. If the plants are kept too cool in the Fall the wood becomes hard and the plants will take a rest from which it will be hard to get them started again. Aim to keep the plants moving in the Fall without getting them too soft. It is sometimes advisable to rest varieties in the Winter time for certain reasons. Then the temperature may be reduced and also the water supply. As a rule, the higher the temperature carried the more water the plants will require. In some of our Rose factories where flowers are turned out daily by the

10,000, water is applied more or less heavily at the roots three times weekly during the growing season.

The crops may be easily regulated by pinching off the buds. Commence on the back bed and pinch back, take the next one the following week and so on every week or ten days as required.

STOCK MUST BE CAREFULLY SOLD

Always aim to have the best Roses grown in your market and you will be sure of customers all the time.

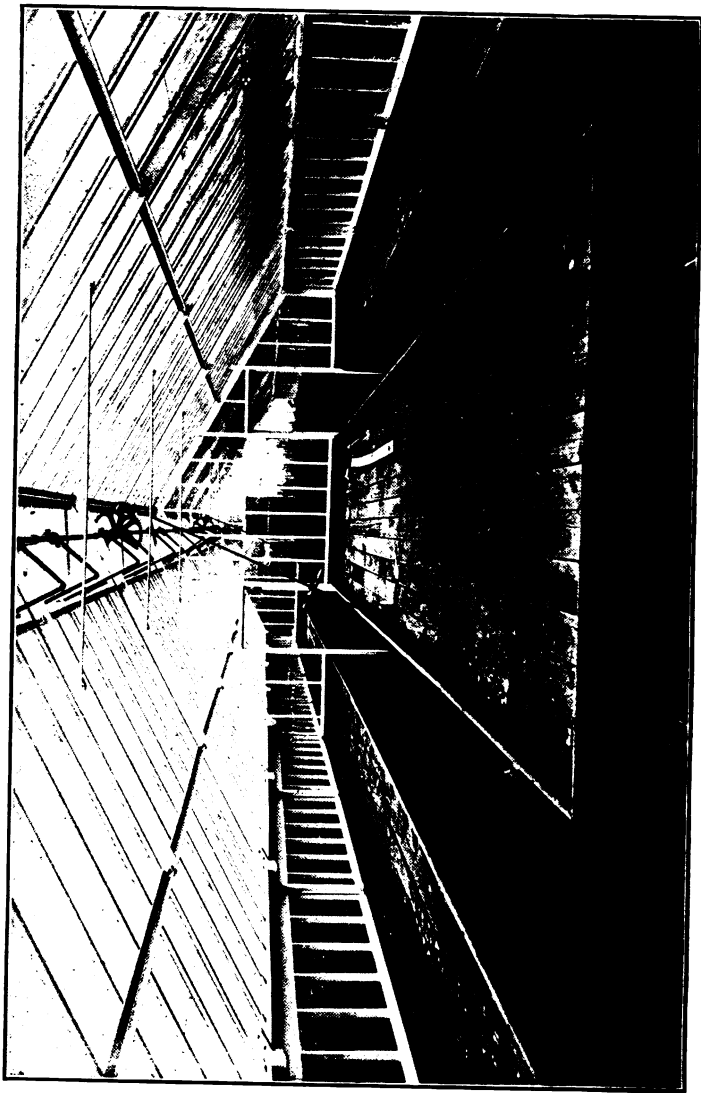
A fair average cut for a year with 20,000 plants in mixed kinds would be 40 flowers per plant, and a fair price would be three cents per flower averaged throughout the year. The cost of selling ranges from 7% to 20% of the sales according to how it is done. Next to growing well and at the lowest cost, the selling of the stock is of the greatest importance and should not be left to an incompetent or unreliable party.

While it is impossible to give any last word regarding modern methods of commercial Rose growing it may be stated that the fundamental principles of this art never change. The grower who can take advantage of his knowledge of these, and apply his wisdom so that everything works together to the end of producing the largest number of good flowers for the lowest cost, will be the most successful.



Fig. 1

Courtesy John A. Payne, Jersey City, N. J.



Courtesy John A. Payne, Jersey City, N. J.

Fig. 2

CHAPTER XX

GREENHOUSE CONSTRUCTION FOR ROSE GROWING

No. 1 is an outside view of two iron frame houses of the commercial type, 20 feet wide and 50 feet long, set ridge and furrow, one of the houses shown being used for growing Carnations and such like stock, and the other for Roses of low growth such as The Bride, Bridesmaid, etc. The construction of these houses consists of a flat iron rafter, set every 8' 3" apart, each rafter being secured to a cast iron foot piece, set in concrete below grade. The rafters are joined together by means of angle iron roof purlins which support the wooden roof bars between the iron rafters. The eaves of the house in this case consist of a cypress eaves plate, but the same construction of house could be furnished with either an iron "T" or an angle iron eaves plate, either of which is more desirable than the wood, as they are ice clearing and prevent the accumulation of snow on the roof.

Between the grade and wood sill in this case double board and paper are used, but, in many instances, concrete or hollow tile is found much more desirable. Where the houses join together an iron gutter supported on pipe columns is used. Each house is furnished with two lines of continuous roof ventilation operated with standard sash opening apparatus.

The benches consist of cypress, the legs and bearers being made of 2" x 4" material and the tops and sides of 1" thick material. These houses were glazed with 16" x 24" double thick "A" glass, set the 16" wide way; the heating apparatus consists of steam. The house used for Roses is piped to maintain a temperature of 55° to 60°. Of course, the same char-



FIG. 3

Courtesy John A. Payne, Jersey City, N. J.

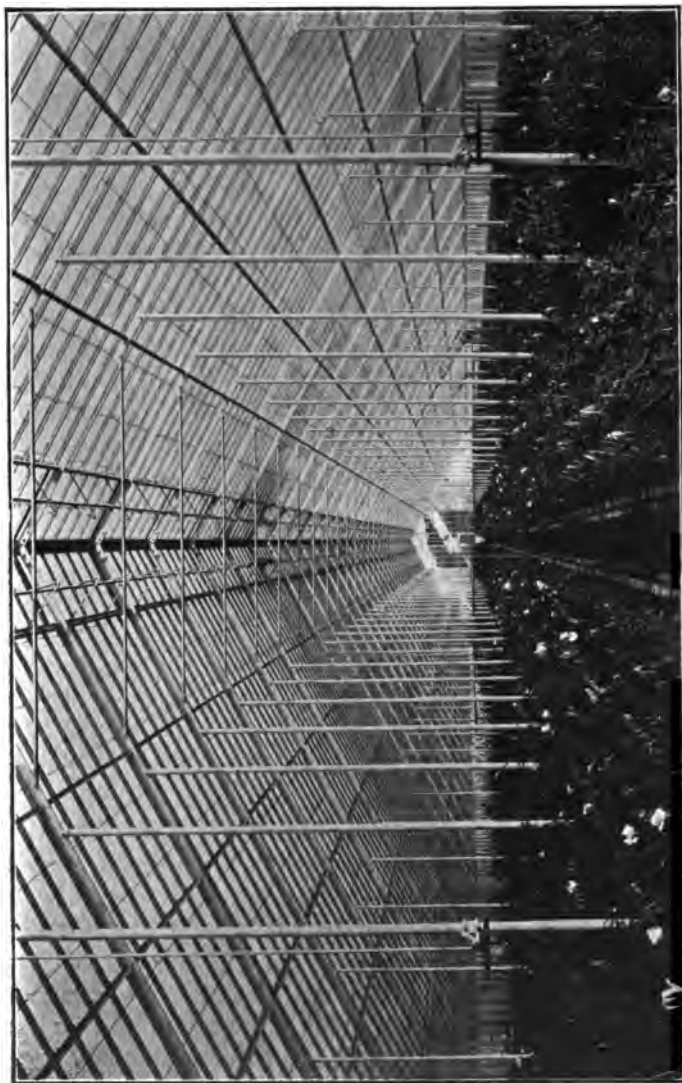


FIG. 4

Courtesy John A. Payne, Jersey City, N. J.

acter house could be constructed for Roses of a higher growth by making the sides correspondingly high.

No. 2 is an interior view of one of the houses given here for the purpose of showing the arrangement of benches.

Nos. 3 and 4 show exterior and interior views of a large commercial house used principally for growing American Beauty Roses. This house also consists of a flat iron rafter frame, the rafters being spaced about 8' 3" apart and supported with columns as shown in No. 4.

This house is 35 feet wide and 317 feet long. In this instance, also, wood siding was used, but more permanent results could be obtained through the use of concrete or tile, which is the most modern method.

In this case solid beds were used about 2' high. These were formed by the use of 2" boards secured to stakes set in the ground. The heating consists of hot water, a temperature of 60° being maintained when the outside atmosphere was at zero. This house gave excellent results in growing American Beauties.

Nos. 5 and 6 show exterior and interior views of a better quality of house. This house is 18' wide and 50' long, with a horizontal partition midway, one compartment being used for growing Roses and the other for general stock. Every bar of this house consists of an iron bar capped with wood to hold the glass. The eaves of the house are curved, thus doing away with the heavy eaves plate and so decreasing the shadow in the house. The strength of the bar is such that glass 24" wide may be used. This construction gives a house of the greatest strength, with maximum light and, for flower production, is by far the best type of construction.

This house may be made of any width or height and can be composed of one or the other of the two types of construction on the market today adapted for this purpose, either the Pierson "U"-Bar or Payne "T"-Bar constructions. Where short curved eaves of this character is used it is better to employ

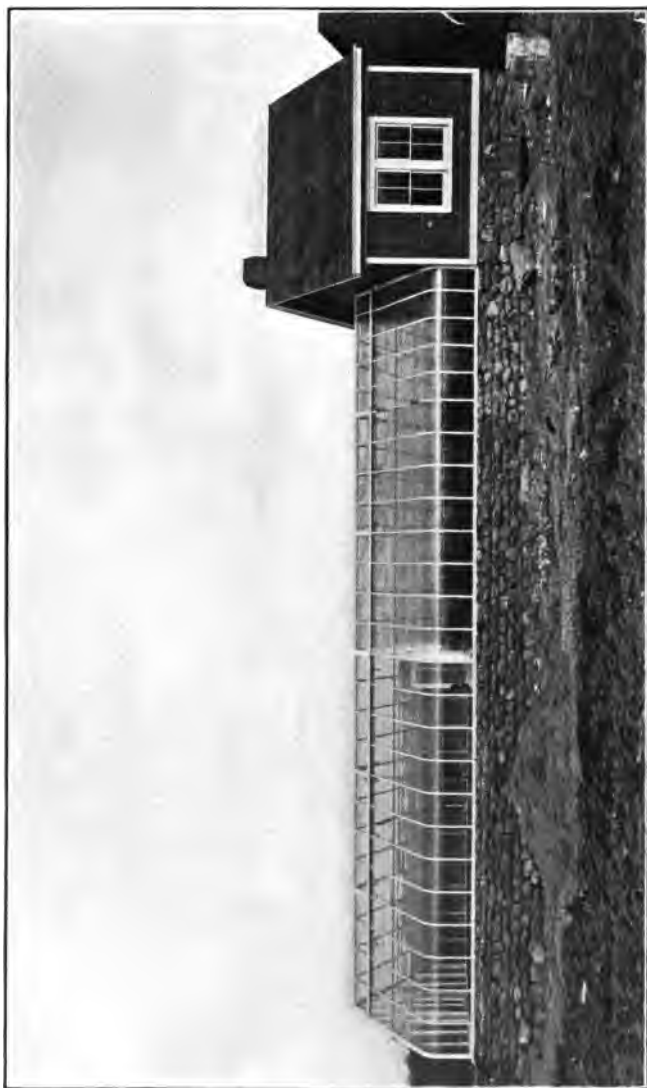


FIG. 5

Courtesy John A. Payne, Jersey City, N. J.



Courtesy John A. Payne, Jersey City, N. J.

FIG. 6

the all steel construction as described, owing to the fact that where flat iron rafter houses are used there is a certain amount of weakness between the iron rafters. In the construction of this house, iron frame beds with cypress sides and tile bottoms were used. The heating consisted of hot water, the Rose house being warmed to a temperature of 55° to 60°. The all steel makes an exceptionally durable structure and, as there is practically no wood inside, it can be easily kept free of vermin and fungous growth and is, therefore, the most desirable character of house for Rose growing. The height of the sides can be regulated according to the character of Roses to be grown.



ROSE SUNRISE

CHAPTER XXI

STEAM HEATING AND ENGINEERING

AS fuel and steam heating play such an important part in Rose growing it has been thought advisable to include a chapter on this subject in this book. It will be my aim to present this in such a simple form that it may be understood by the beginner, for I realize that experts have no need of this knowledge.

The three elements of Nature which we must understand in steam engineering are air, water, and fuel.

AIR, WATER AND FUEL—1, AIR

Air is composed principally of the three gases, nitrogen, oxygen and carbonic acid gas, in the following proportions: nitrogen, four parts, oxygen, one part, with a slight admixture of carbonic acid gas.

The most important of these is oxygen, for, without it, we could not live, neither could combustion be maintained.

The atmosphere has a pressure or weight of $14.7 \left(14 \frac{7}{10}\right)$ lbs. per square inch at the sea level. The higher we ascend in the air the less the pressure becomes. The displacement of the air causes the water to rise in a pump or siphon. When filling a boiler with water the air cocks or valves should be opened at the highest point to allow the air to escape.

A vacuum is a space from which all the air has been removed and this system of heating is in use at some establishments. Air that is confined (called dead air) is a good non-conductor of heat or cold, while air in circulation will heat or cool a room.

2, WATER

Water is composed of oxygen and hydrogen; it is compressible and elastic, but the change is very minute and has no practical consequence. A column of fresh water 27.71 ($27 \frac{71}{100}$) inches high, at a temperature of 62 degrees Fahr., would exert a pressure, at the bottom, of one pound, while at the same temperature a column of fresh water 33.947 ($33 \frac{947}{1000}$) feet high, would have a pressure of one atmosphere = 14.7 lbs., per square inch at the base. Water is 815 times heavier than air at the sea level with a mean temperature, 56 degrees Fahr. Fresh water will boil in a vacuum at a temperature of 72 degrees Fahr.; in the open air at sea level at 212 degrees Fahr.; and under a pressure of 15 lbs. per square inch at a temperature of 234 degrees Fahr.

Water is the heaviest, or at its greatest density, at about 39 degrees Fahr.; at this point it will expand with either heat or cold. From this fact it is evident that there is a point on either side of this temperature where the water has the same weight, and this point is reached when the water is at 32 degrees and 47 degrees Fahr.

Water will expand in rising from 60 degrees Fahr. to 212 degrees (its boiling point) 2 1-4 per cent. in volume. On account of its solvent power water is never obtained pure except when freshly distilled. It dissolves minerals, vegetables and gases. It holds foreign matter in suspension and in solution. The particles held in suspension can be filtered out. The matter held in solution can only be separated by evaporation. Salt in water raises the temperature of the boiling and lowers that of the freezing point.

3, FUEL

The third point to be considered is fuel. Artificial heat is in the most common form derived through the combining of the

two gases, oxygen and hydrogen, with carbon, which is a solid. The two elementary bodies which give the heating power to all fuels are carbon and hydrogen. It is said that one pound of carbon will heat 14.220 lbs of water 1 degree Fahr., while one pound of hydrogen will heat 52.155 lbs. of water 1 degree Fahr. A unit of heat is an amount of heat required to raise one pound of water one degree Fahr.

Combustion is the term applied to the process of burning, due to the oxygen of the air passing into a state of chemical union with the carbon and hydrogen of the fuel. This combination always generates heat. One hundred and fifty-six cubic feet of air must pass through the grate for every pound of coal consumed; about one-fifth part of this air is oxygen.

Some grates are cast with insufficient air space. It is said that one-third of the grate should consist of air space. Some firemen wet their coal for the reason that heat resolves the moisture into steam, and finally into carbonic oxide and hydrogen. If the draught supplied to the fire is sufficient, both these gases will burn.

One ton of average coal is equal to two cords of average wood for steaming purposes. Coal is divided into two primary divisions: anthracite, or hard coal, which does not flame when kindled, and bituminous, or soft coal, which does. The reason is the soft coal contains so much more hydrogen and ignites at so low a temperature that it flames the instant it touches a hot fire. Anthracite coal sometimes contains as high as 94 per cent. of carbon. As this element decreases in amount it graduates into a bituminous coal. The term anthracite is applied to coal containing 80 per cent. or over of carbon. The maximum consumption of coal for steam boilers is, with natural draught, 12 pounds per hour for each square foot of grate surface.

The value of any fuel is measured by the number of heat units which its combustion will generate. The two sources of waste in fuel burned under steam boilers are, first, the gases



ROSE MY MARYLAND

One of the most profitable Summer Roses grown. Requires more heat than other kinds to grow freely in Winter

Courtesy A. N. Pierson, Inc., Cromwell, Conn.

going to waste up the chimney; in some cases this averages 30 per cent. while, under the best conditions, it is 12 per cent. It is very important to always keep tubes and flues thoroughly clean as the heat is then absorbed by the boiler instead of going up the chimney to waste. The other source of waste is in systems where cold water has to be often fed to the boilers; where the water can be returned to the boilers hot without loss, a great saving in coal is effected.

Greenhouses are generally heated by low pressure steam which means a pressure of less than 15 pounds per square inch. This is the most economical form, as the relative volume of steam decreases faster than the temperature increases as the pressure rises.

CARE OF THE BOILER

Horizontal return tubular boilers are commonly used for steam heating; these, when properly set in brick, will last for years and give good results. The furnace is the space above the grate where the fire lies. The fire sheet is the sheet or part of the boiler directly over the fire. The ash pit is the space below the grate and it is important to keep this cleaned out every day or the accumulation of ashes will obstruct the passage of air through the grate and also cause the burning out of the grate. The bridge wall is the wall at the back end of the grate, in the style of boiler we are considering. This wall is to keep the coal from falling off the back part of the grate and to force the flame up to the bottom of the boiler; also, when the doors are opened to put on fresh fuel, it reduces the amount of cold air that will be drawn in under the boiler back through the tubes and up the chimney.

The combustion chamber is the space back of the bridge wall. All boilers should be provided with a blow-off pipe at the bottom, which should be opened once or twice a week to clean out any sediment which may accumulate. The safety or



ROSE BON SILENE

**Very small buds. An old variety but still popular with customers
in the best stores**

Courtesy W. J. Palmer & Son, Buffalo, N. Y.

fusible plug is placed at the low water line in a boiler; this is a few inches above the top of the tubes; if the water gets below this the plug will melt and, through the escaping water or steam behind the boiler, an alarm would be given to the fireman. The manhole at the top of the boiler is for the purpose of entering to examine and clean, inspect or repair it. The hand holes are the small openings for cleaning and inspecting the boilers. These should be opened every season and the bottom of the boiler inspected and swabbed out with a cloth or brush on a pole, and washed out with a nozzle on the end of the hose. The heating surface of a boiler is the portion exposed to the fire which must, of course, always be covered with water. If any dirt accumulates on the bottom of a boiler the water is kept away and the fire will burn this part, causing a sag or uneven place in the plate; this, in turn, makes a hollow place for the dirt to lodge and has to be watched very carefully or the boiler will soon be ruined.

THE GRATE

From four to five feet in length of grate bars gives the best results with this type of boiler, and shaking grates are much better than stationary ones, from the fact that they break up the fire and do not allow of clinkers being produced and, most important, being operated without opening the fire doors to admit so much cold air, they do not cause such a cooling off of the boiler plates. The fire is also kept more level on the grate, as it should be. On some of our largest places the stationary grates are being torn out and shaking grates installed in their place; the saving in fuel in one or two seasons is said to offset the outlay.

The horse power of a boiler is three times the square feet of grate surface with natural draught. The space left over the bridge wall under a return tubular boiler should be eighteen square inches of space per horse power of the boiler. The area of the chimney should be about one-eighth the area of the grate.



ROSE SAFRANO

A very old variety, but still popular in stores where novelties are in demand

Courtesy W. J. Palmer & Son, Buffalo, N. Y.

In starting a fire under a boiler where everything is cold a small fire should be carried for awhile so that everything may be warmed slowly or there is danger of unequal expansion and injury to the boiler. Also, in a brick set boiler, if for any cause it is shut down and the water is to be blown off, do not attempt this until several hours after the fire is out and the brick-work has had time to cool off somewhat.

THE SAFETY VALVE AND WATER GLASS

The most important fixture on a steam boiler is the safety valve; if this is of sufficient size and in good working order there is no possibility of getting an over pressure of steam. The safety valve should have one square inch area for every two square feet of grate surface. It should be tried at frequent intervals by gently raising with the hand on heating boilers and, on pressure boilers, the steam should be run up to the blowing off point when, if it does not start, it will have to be gently started by hand. There is generally about three pounds difference between the opening and closing of a safety valve from the fact that there is a greater surface exposed to the steam when it is open. A pop or spring safety valve, which is locked so that no one can tamper with it, is the safest to use.

In case a safety valve gets stuck, and the steam is found too high, or in any case where we suddenly want to do away with the heat under a boiler, close the dampers and cover the fire with ashes or fine coal; this will cool it off more quickly than the old way of drawing the fire. Afterward, if necessary, the fire can be drawn. In case the safety valve is stuck do not attempt to release it until the pressure is down to normal, then gently raise it with the hand. If raised when the pressure is too high steam would be rapidly disengaged from the water and the strain on the boiler will be greater than if it was left alone.

The water glass and gauge cocks are for the purpose of showing the height of water in the boiler and should be blown

out every day. Close both the upper and the lower valve in turn, and blow the water or steam out through the cock at the bottom of the glass; also blow out the three try cocks in the water column. If a water glass breaks, close the valve at the bottom of the glass first and then close the upper one; there is not so much danger of getting burned in this way.

BOILER TROUBLES

Foaming in a boiler is shown by the jumping up and down of the water in the glass and is caused by dirty water and by forcing a boiler beyond its capacity. It can be remedied by cleaning out the boiler as soon as possible. Care should be taken that water does not leak down on to the outside of a boiler; if this happens corrosion will take place in a short time.

Boiler tubes should be scraped out occasionally as a thin carbonaceous scale is liable to form which results in a great waste of fuel. This scraping is in addition to the brush or to the blowing out with a jet of steam. It is estimated that 15 per cent. more fuel is used in a dirty boiler than in a clean one to obtain the same amount of heat.

THE CHIMNEY

To get the best results from a chimney every bit of air that enters it should pass through the grates. Round chimneys are better than square ones for the gases ascend in a spiral motion. In their construction brick is better than iron, for the current does not get cooled off so much in its ascent.

FEEDING THE BOILER

Be careful when feeding cold water into a boiler to do so very slowly as the cold water is heavier than hot and settles to the bottom of the boiler. In theory this is bad for the plates, but in practice it is perhaps impossible to cool off a boiler with a fire underneath it. The water should always be carried at a uniform height in a boiler and there should never be less than

three inches of water above the top of the upper row of tubes. If a tube should split, or become pitted so that it leaks, a dry Pine plug may be driven into either end, when it may be run for a day or two until a new tube can be put in.

Wetting down ashes and clinkers close to the boiler front will cause corrosion of the boiler metal and do harm. Coal which contains much sulphur will form an acid and corrode the plates. Any cracks in the brick setting of a boiler should be pointed up as they admit air, chilling the boiler and cooling off the gases.

To prevent the gaskets from sticking to the hand and man-hole plates coat them on both sides with graphite or plumbago and oil. A good putty for joints is made by mixing white lead ground in oil with dry red lead into which a little asbestos may be worked if it is to be used near the fire.

THE ART OF FIRING

When firing, feed with coal little and often; keep a level fire about six inches thick; a fire too heavy is wasteful, for the air is not so well able to get through the grate. Avoid holes in the fire and keep it clean so that it looks bright the whole distance in the ash pit with the heaviest fire toward the back.

If too hot a fire is carried at the front there is the liability of burning the furnace doors and, also, if the brickwork over the arches is not in good repair there is the danger of burning out the dry sheet which is the sheet outside the part containing the water. Some types of boilers do not have this overhanging dry sheet.

Burn the fires down as low as possible in the morning; clean them and push the fire back up to the bridge wall, then bank it with fine coal and keep all the doors shut. If any gas is noticed the damper in the chimney may be opened slightly. Some firemen leave the furnace doors open all day; this wastes the heat and does harm to the boiler plates by admitting so much cold air,

causing it to take a much longer time to get up steam in the afternoon. When steam is required, open the draught, after a few minutes, when the fire is burned enough, spread it evenly over the grate and cover lightly all over with fresh coal. In this way steam may be gotten up in from ten to twenty minutes after starting the fire.



ROSE STYLOSA

CHAPTER XXII

HOT WATER HEATING

THE improvements in this method of heating have been so great during the past few years that this system is worthy of careful consideration. The advantages of hot water over steam heating are stated by those who favor this method to be as follows: Economical operation, even heat, perfect control, absolute safety, and that it can be operated with low fires and will maintain an even and steady temperature with less attention than steam.

Hot water is now being used extensively as a medium of heating greenhouses for all kinds of crops, and, of late years, many large Rose establishments are being heated in this manner. When used for Rose growing, it should be arranged in small units of radiation, and at this time it is the practice to control each and every return line by independent gate valves. With gravity circulation you can heat coils up to 250 feet in length; with forced circulation there is no limit to the length of houses or size of the plant to be heated by hot water.

Any size of pipe may be used, but the ideal piping systems of today are 2-in. and 4-in., and large flows with 2-in. returns. The following sizes of piping can be employed, if desired: For houses up to 100 feet in length, 1¼-in. returns; for houses up to 150 feet in length, 1½-in., and up to 250 feet in length, 2-in. returns.

With hot water heating you require an open expansion tank for a gravity system, and for a system to work under pressure, a good sized closed tank, elevated several feet higher than the highest point of the system, and so located as to make direct connection with the main return near the boiler.



This range is devoted to vegetable growing and consists of twenty-five houses, each 750 ft. long, heated by hot water. Circulating pump used

Courtesy Kroeschell Bros. Co., Chicago, Ill.



Interior of Rose house showing hot water heating system
Courtesy Kroeschell Bros. Co., Chicago, Ill.

It is not within my province to recommend any particular make of generator, circulator, or pump, but I would advise, as a means of saving money in the end, that you consult a reliable firm of greenhouse heating engineers and get them to figure on your requirements.

The returns should have a steady pitch back to the boiler of about 10 in. in 100 feet, and there should be no low places or pockets in the system. Vents should also be placed at the highest points in a pressure system to allow the air to escape. Water in a common gravity or open circuit system cannot be heated above 212 deg. F., while water at 15 lbs. pressure will be 234 deg. F.

I have personally had little experience with hot water heating, but the modern system is so well liked and so highly recommended by parties who are using it, that it is well worth considering. The best type of boiler for this purpose is the saddle back, as this type holds a very small volume of water, and it has an immense amount of direct heating surface, therefore heats up very quickly, and it is claimed that it operates more economically than any other type of boiler construction known. There is really no comparison between the old fashioned gravity system with its clumsy 4-in. pipes and leaky joints, and the modern pressure system with small threaded pipes and rapid, forced circulation. It would certainly be wise for the smaller places, where no regular night fireman is employed, to consider this method of heating.

The accompanying illustrations show better than words can describe a few of the places being heated today with hot water. This would seem to be sufficient demonstration of the capability of this system.



View showing conservatories of President of United States, at Washington, D. C.,
heated by hot water gravity

Courtesy Kroeschell Bros. Co., Chicago, Ill.

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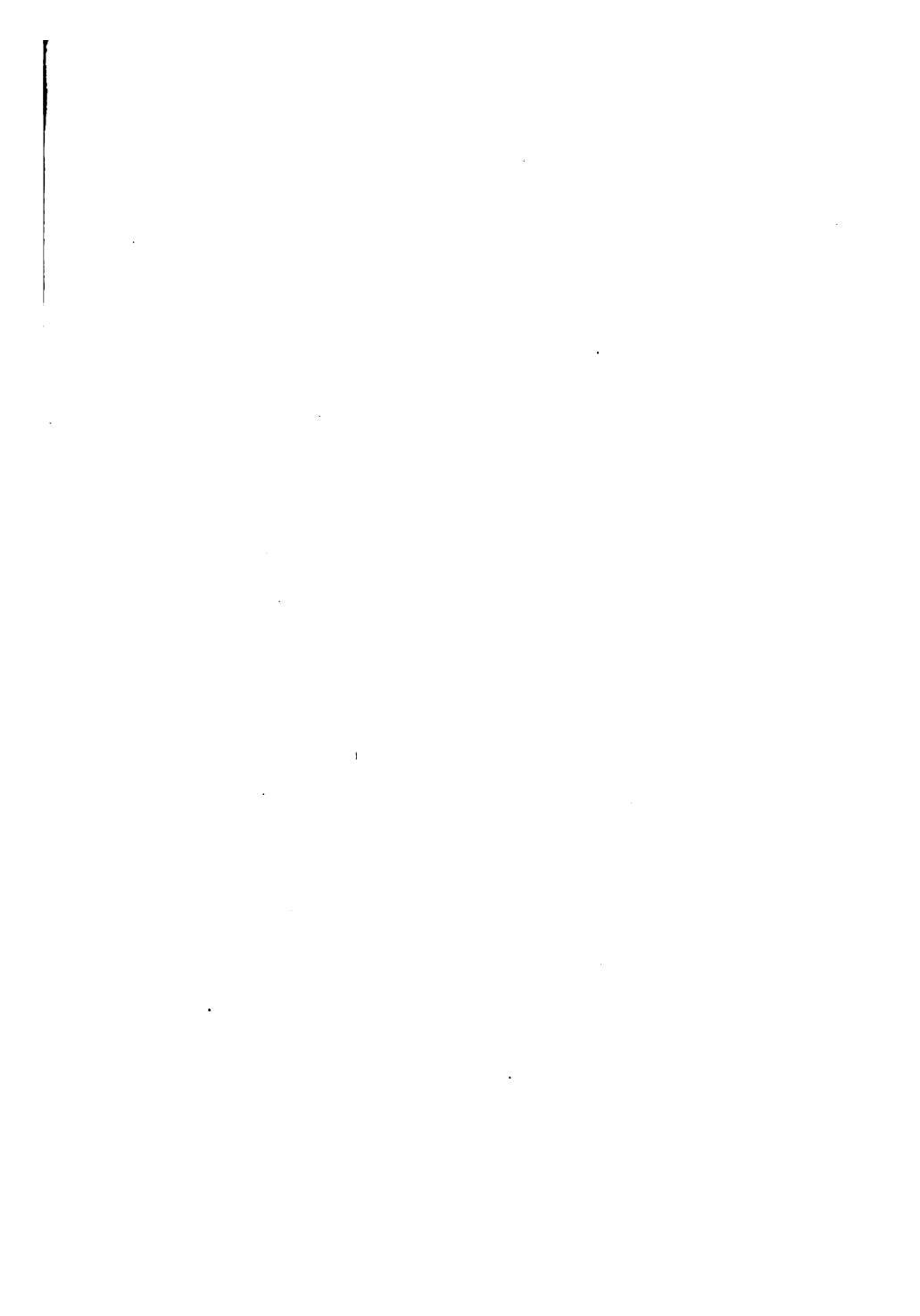
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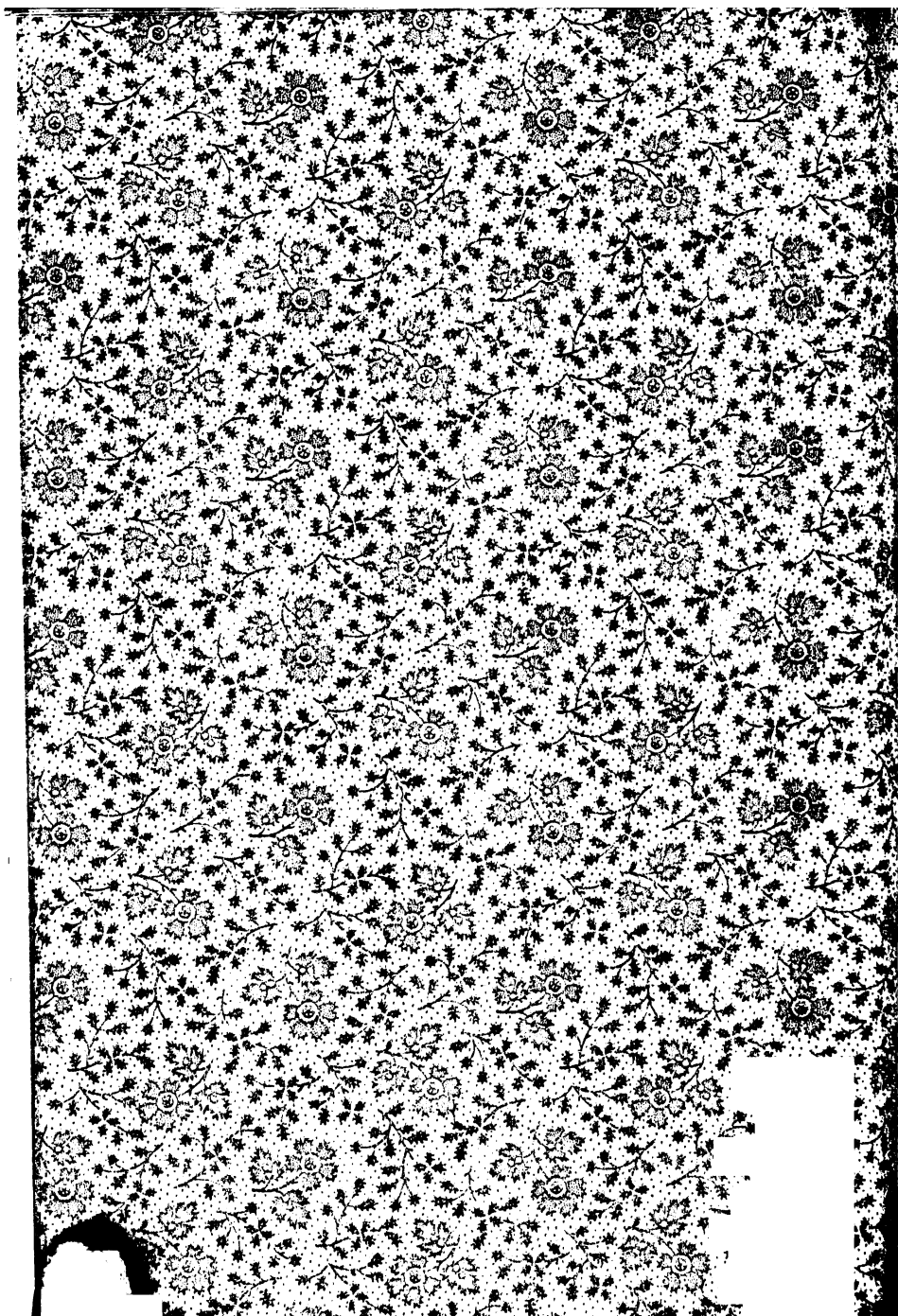
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